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Attention is Invited to the following advertisements, appearing for the first time in this number :

—*Falling Cliff Zinc Mine*, which is offered for sale, is one of the most valuable properties of its kind that we know of, and we commend it to investors. It adjoins the noted Bertha mine, from which thousands of tons of zinc ore, yielding 45 per cent. on an average, have been taken, and from which the supply of ore is drawn for the furnace at Martin, on the A. M. & O. R. R. that has a capacity for making 1300 tons of pure spelter a year. The Bertha mine is at the foot and on the slope of a hill, of which the Falling Cliff holds the top and opposite slope. We visited this mine last summer, accompanied by Prof. Campbell, and were enabled to judge of its extent and character from the experimental shafts and pits that had been sunk to the ore, and from its relations to the extensively developed Bertha mine adjoining. Mr. D. S. Forney, who discovered and brought the Bertha mine into notice, will give any information desired, and what he says can be relied on.—We shall have more to say about the zinc mines of Wythe in our next.

—*Virginia Agricultural and Mechanical College* begins its next session Feb. 24th, 1881. Virginia boys have here a good opportunity for obtaining an education at a moderate cost, under the direction of excellent teachers.

—*Wesleyan Female Institute*, of which Rev. Wm. A. Harris, D. D., is the President, is a central, leading female college, patronized from a majority of the states of the Union. Ably conducted, located in a thriving town in the midst of the great Valley of Virginia, in the salubrious atmosphere of an altitude of 1500 feet above the sea, in latitude 38°, it has many advantages to offer as a place for the education of young ladies.

—*The Staunton Iron Works*, to be sold by commissioners, under a decree of court, February 24th, to settle the affairs of an estate, is a very desirable property in one of the best locations in the country for a foundry and machine shop. Orders are now on hand for work far in advance of the ability of this well appointed establishment to meet them. The large development in manufacturing now taking place in this region, adds largely to the desirableness of this property.

—*The Mineral Land* offered by G. J. Barnhart, in the mineral belt of Piedmont Virginia, and in a fertile region, is worthy of attention.

Salisbury Manufacturing Co., M. F. Maury, M. E., Supt., has its Salisbury furnace at Catawba-mouth, (Saltpetre-cave, P. O.), on the line of Richmond & Alleghany RR., Botetourt Co., Va., ready for the manufacture of charcoal pig, and it will soon go into blast. About 2,000 tons of ore, mined in 1880, are on the stock pile, as is also a good supply of charcoal. About 150 men were employed in 1880.

Tinsalia Coal and Iron Co., as we learn from its superintendent, Gen. J. D. Imboden, under date of January 22, has made arrangements for the extension of its railway through North Carolina to the sea, opening a new route and to new markets from Virginia's great coal fields in Wise, Dickenson and Buchanan counties This company has secured 60,000 acres in the Big-Stone-Gap coal basin, Wise county, where there are millions of tons of the best of coal, above water level—one bed. [illegible] ft. thick, yielding a coke with less than 3 per ct. of ash and xceptionally rich in carbon. By its railway, in process of rapid construction fr[illegible] the mines at Imboden City *via*. Estillville to Bristol-Goodson, on the A. M. & O. and as projected through N. C., it will be but 100 miles to the rich magnetic iron ores of N. C., and on its way to the seaboard it will cross all the ore-belts of that state, furnishing a cheap and superior fuel for converting them into iron.

This company, full of energy and having ample means to carry out its purposes, will not only reap abundant rewards to itself, but will also be a great benefactor to the state, by developing and utilizing the vast and hitherto wholly unused mineral resources of the extreme southwest.—In accordance with our plan of presenting full and reliable information in reference to the mining interests of these states, taking up different regions as they become of present importance, we have arranged and shall in our next issue (unless delayed by the illustrations) present to our readers an elaborate paper, illustrated by sections and a colored geological map, on the Geology of Wise, Lee and Scott counties, by Dr. John J. Stevenson, professor of geology in the University of New York ; a paper furnishing, especially, full information in reference to the minerals of the region in which the Tinsalia Company is operating. Prof. Stevenson spent several months of last year in a detailed exploration of that region, as previously stated in THE VIRGINIAS.

Gauley-River Iron Co., of which J. F. Lewis, A. Pluemer, B. J. Jordan, R. S. Jordan and W. W. Culbertson are corporators, having filed articles of incorporation, held its first general meeting at Quinnimont, W. Va., Feb. 5th, as we learn from the *Fayette Enterprise*. This company has been formed for the purpose of erecting a furnace and manufacturing iron at a place 5 miles up Gauley river, Fayette Co., W. Va., where it has purchased lands containing coal and iron ore. Gauley river has been made navigable for bateaux to the furnace site.—The Buckles branch black-band iron ore that will be used yielded to Prof. J. L. Campbell's recent analysis 34.25 per cent metalic iron, 24.15 carbonaceous matter, 3.20 silica, 0.41 sulphur, and 0.19 phosphorus.

Forestry.—C. G. Pringle, botanist, of Charlotte, Vt., who has been gathering information in reference to the timber resources of West Virginia for Prof. Sargent, who has charge of the department of forestry of the 10th-Census, called on us a few days ago, on his return homeward. He was much impressed by what information he had collected. The unusual character of the winter kept him from seeing any of the forests, and the unwillingness or inability of those he sought information from to give it, left him with poor results for properly presenting the timberstatistics of a state second to none in the Union in forest resources.

The Keyser Iron-mine, on the land of Mrs. Keyser on the west side of Peter Mn., in the Dunlap creek valley, Alleghany Co., Va., some 3 miles from Trice Switch of the C. & O., has been opened, since last September, by Mr. W. M. Bryan, formerly in charge of mining operations at Mt. Vernon Furnace in Rockingham, for the Pa. and Va. Iron and Coal Co., and up to January 1 some 400 tons of superior ore were shipped to Quinnimont. Eight men were worked in the mine.

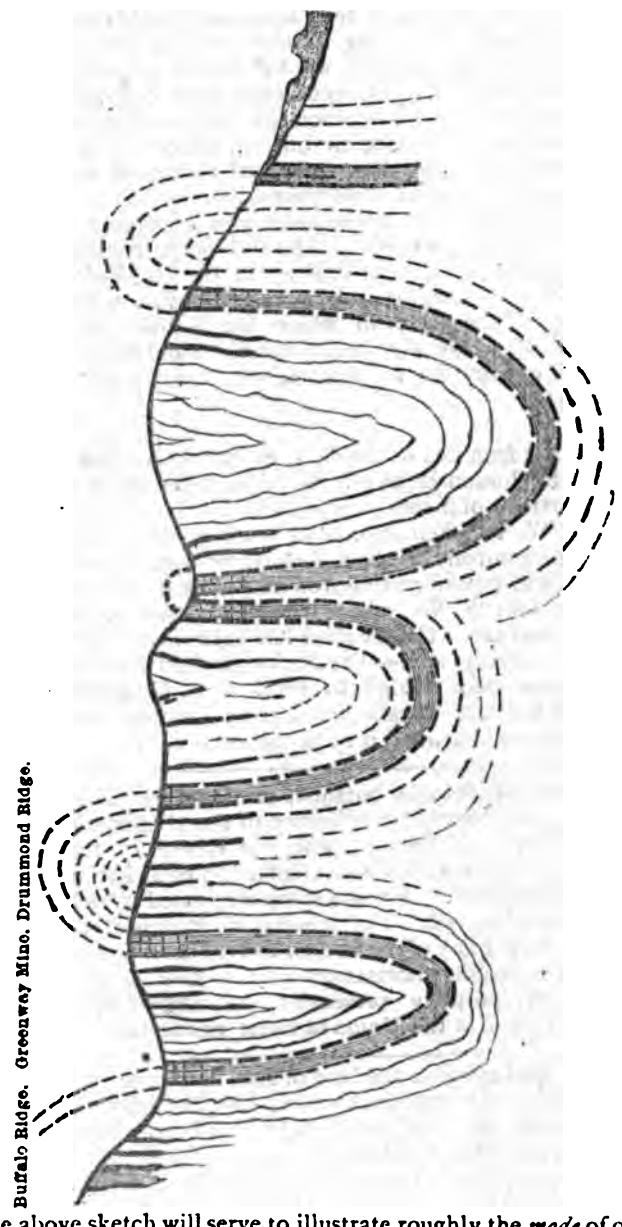
On the Arcadia Furnace Property, Botetourt Co., Va., 25,000 tons of specular ore were mined in 1880, about 100 men having been employed in explorations. The ore is lying at the mines awaiting the completion of the R. & A. RR., which runs, for many miles, opposite this estate.

Greenway Iron Ore Belt, of the James River, Va.

ıcts from a Report of a Reconnoissance of the Estate of the Central rginia Mining Co., by Jas. P. Kimball, Ph. D., F. G. S.—Made r THE VIRGINIAS.

The ores of the James River ore belt are in the form of bedded veins occupying regular horizons, which are remarkably well defined. They are interposed between strata of different characteristics which are practically parallel throughout the belt. They are therefore distinctly traced and recognized. These include quartzites, sandstones, damourite and other talcose schists, chloritic schists and talcose (micaceous) limestone, forming a series of strata over 1,500 feet in thickness (1,500 to 3,000 feet), but by frequent plication they have been folded sharply upon themselves so as to constitute a belt at the surface several miles across (from 6 to 8).

It would require a minute and extended study of the belt, with the aid of far more extensive development than has yet been accomplished, to determine how many times within the belt, or even within lesser limits, such a repetition of the series has taken place. Thus within the Greenway boundary some thirty outcrops of ore have been discovered between the planes of contact of different strata. The number will doubtless be found to be still greater by further explorations toward the summit of Buffalo Ridge, and in all of the valleys between ridges. These numerous outcrops are all referable to a less number of horizons, which have been repeatedly brought to the surface by folds, the nature of which may be approximately illustrated by the following crude sketch, showing possible plication of iron ore deposits on the assumption of but one belt of limestone. This is the mode of replication of strata, although the order as here exhibited is not yet established.



Buffalo Ridge. Greenway Mine. Drummond Ridge.

The above sketch will serve to illustrate roughly the *mode* of occurrence of the ferriferous series of strata of the James River belt, especially on the Greenway property. But my examination has not been sufficiently detailed to exactly determine such a construction, as whatever it be when established, it will involve the indentity not only of separated belts of limestone, and other strata of the series, but also of separated deposits of ore. I give this sketch merely to indicate the replication of strata together with the iron ore beds interposed between them, without intending to identify or correlate them in their separated portions. It appears to me, however, by the light of my limited observations with the scanty data at present at hand, that the numerous veins of iron ore are replications of comparatively few beds. Their special identity or correlation can only be ascertained by close and long continued observations, following advanced mining developments.

The same holds true with respect to the other tracts, viz: the Riverville and Stapleton, but it seems probable that the two latter portions of the James River belt contain a less number of plications than the Greenway. This is in part due to the position of these tracts with respect to the whole width of the belt and in part to the relation occupied in these portions of it by the James River.

Numbers have been given to the ore beds on the several tracts, and an attempt made to identify their well characterized ore veins. Any such identification can only be really established, however, after future developments.

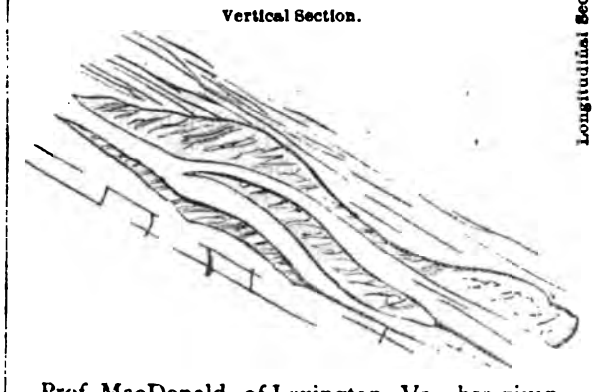
There seems to be a thinning of the strata towards the southwest, by which the ore veins are brought closer together in the Riverville tract than in the Greenway, and in the Stapleton still closer. The plications seem also to have a greater sweep, *i. e.* not to be so sharply folded upon themselves. As my examination did not extend beyond these particular limits, I am unable to decide how this may be in relation to the whole width of the belt. It would seem to follow from this difference that the belt narrows in width in the same direction. This indeed would necessarily follow, if it should be proved that the series is folded the same number of times throughout its whole length.

The ores are disposed in beds or veins between strata of different composition. They seem to me to be, unlike the ferriferous schists of Michigan and Missouri, segregated deposits of ore which have been metamorphosed along with the whole series of strata. The degree of metamorphism has been slight as compared with the Huronian schists above named, and in some cases they are still soft or only partially altered. While specular hematite is the prevailing form of iron ore, some of the deposits are in part in the state of magnetic oxide; others again are admixtures of magnetic and specular oxides; while still others, especially those of which limestone forms one of the walls, are compact brown hematite (limonite)—at least near the surface.

These several forms of ore are found, as above remarked, between the divisional planes of different strata; for instance—between sandstone and damourite schists, or limestone and chloritic or talcose schists. While I have met with no instance in nearly a hundred exposures of contacts between different strata, in which *some* ore was not found, and while it is therefore probable that such deposits occur between almost all of the different members of this series of metamorphic strata, a difference in size and richness, as well as in other qualities, will doubtless be found upon development, in kind if not in degree, similar to what is seen between them as exhibited by the upper or outcroping portions.

These of course, have suffered to a variable extent from weathering. The maximum size of any of the deposits that came under my observation is about five feet. The general average width will probably be found between three and five feet. They are both in length and dip lens-shaped masses of greater or less longitudinal extent, and are disposed as shown in the following ideal sketch.

Vertical Section.



Longitudinal Section.

Prof. MacDonald, of Lexington, Va., has given a section of the ore belt at Riverville on the assumption of three beds of limestone and a single synclinal structure or basin-like configuration of the whole series of strata. Hence a greater thickness of the ferriferous series than has thus far seemed to me probable, on special grounds

as well as on the ground of its general analogies with the Huronian and Cambrian elsewhere. The great number of iron ore beds on the contacts on the Greenway tract itself, however it may be on the Riverville tract, and the occurrence more than twice of features evidently characteristic of certain horizons, suggest a configuration more as in the above sketch on the assumption of but *one*, or, at the most, *two* beds of limestone.*

The Greenway vein, so called, is remarkably continuous and well defined as far as developed, averaging in thickness within the workings of the Greenway mine not less than four feet.

The present shaft-workings of this mine occupy a single shoot, some 500 ft. in length, in Drummond Ridge. This shoot has a dip of 85° and a southeasterly pitch of about 45°. Other shoots in close succession on the same horizon are indicated by explorations. In its pinch and shoot structure and in its pitch (as distinguished from dip) the Greenway ore-body resembles the magnetic ore-beds of southern New York and northern New Jersey, but, unlike them, is made up of smaller lentiform bodies, more like chalcopyrite deposits in mica schists as seen in mines at Vershire, Vt., and at Ducktown, Tenn. These features are shared by all the other beds of specular ore thus far opened, however it may prove in the case of the magnetites and limonites.

The ores lowest in phosphorus, according to the analyses furnished me by Mr. Dunlap, and since made from samples collected by myself, seem to be those in which opal quartz is the principal earthy admixture. The presence of this mineral, known in the region as guinea quartz, in a number of veins of the series in each of the tracts, points also to a repetition of the same seam.

The ores will doubtless be divided, as in all such deposits, into first and second-class ores, according to their percentage of iron. As large a proportion, as often occurs, will doubtless be found to be within the standard of first class shipping ores. The thickest portions of the courses of ore seem to be the richer. Courses of quartzose impurities are present in the Greenway bed, but to no serious extent.

The *demonstrated* value of the Greenway tract chiefly rests upon the long extension of the so called No. XVI or Greenway vein of micaceous or specular ore, which has been exhibited at intervals for a length of not less than seven or eight miles.

A great number of encouraging prospects are exhibited, but have not been carried to such a degree of development as to call for any special description. In fact, all may be adequately described in general terms, as their conditions are remarkably uniform. Any practical differences among them will be as to quality of the ore and as to their size, in which respect others, besides the Greenway, will doubtless be found satisfactory. The repetition of the Greenway horizon promises a repetition of the same conditions possessed by the Greenway mine.

The *demonstrated* value of the Riverville & Wingfield tracts is chiefly in No. VI½ vein so called, which has been opened by adits and slopes, and in No. XI vein so called, on the slope of Davidson Ridge, which has been opened by a series of six shafts and drifts to a depth of 150 feet.

No. XIII vein also appears of very satisfactory size, while numerous prospects indicate a rich series of hematites and other ores of the series. The ore of No. XI, although not hitherto supposed to be a steel ore, has, according to Mr. Dunlap, a remarkable record for a foundry ore. Recent analyses by Booth, Garrett & Blair show this ore unexpectedly low in phosphorus.

The *demonstrated* value of the Stapleton tract is chiefly in the Maude belt of ores, which have a fine range on the property, and are among the richest in the region. A number of excellent prospects have been opened—including the Lee Red, Stapleton Cliff, and Lee Cliff. Under each of these designations is embraced a series of horizons containing the usual variety of ores, and among them superior steel ores.

The specimens forwarded by me, and since analyzed by Messrs. Booth, Garrett & Blair, are from all of the important discoveries on each of the above tracts. As commercial averages were impracticable in the case of undeveloped outcrops of ore, my aim in selecting specimens was to take neither the best nor the poorest—thus hoping to approximate in a few specimens to a fair average as to richness. Phosphorus determinations should be made from a larger average. The mean of several analyses of well developed ores will, however, be near a commercial average.

The discoveries hitherto made have been confined to the ridges. Yet it is certain that the valleys upon the strike of the series equally contain deposits similar to those found upon the highlands, while the latter likewise cross all the gaps or bottoms formed by water-courses through these ridges. The valleys, having been eroded from the softer portions of the series in their several presentations to the surface, must be presumed to contain soft and, *pari passu*, good ores. This at least is constantly the case in the iron regions of Lake Superior and the Adirondacks.

All of the ores outcroping in the ridges are capable of being wrought with greater facility than is generally the case with ores of the same high class in other regions of the United States. Adits and cross-cuts, the first from the ends of the ridges, and the latter from their sides, may be easily and cheaply driven so as to work backs of ore varying from 50 to 300 feet, and in a few cases of still greater height. Shaft mining may be entirely dispensed with, and would only be advisable when seated in the valleys. The drifts and cross-cuts should be located with reference (1) to the choice of ores; (2) to topographical conditions, including suitable grades for tramways. Tramways should be laid so as to serve the greatest number of cross-cuts, etc. Sites can be found for cross-cuts which shall cut several ore-beds within short distances. These points require careful consideration, based upon exploration and surface leveling.

On the Riverville location a projected adit will give access to the whole system of ore-beds, and deliver ore directly upon the canal. The rocks are generally soft and easily wrought. A soft "dig" often forms one wall.

Mechanical or power drills should be used in this work. In driving adits or tunnels upon the course of a vein, it will probably be found expedient to excavate the wall of schist rather than the ore-bed itself. No high-grade metamorphic ores in the United States can be more cheaply mined on a large scale.

Market and Transportation.—The existing markets for iron ores, such as are afforded by the James River belt, are the generally northern Atlantic States, and directly accessible iron-making regions like those of West Virginia, western Pennsylvania, and the Hanging Rock region of Ohio and eastern Kentucky. Transportation to the above markets is at present as follows, viz.:

By James River Canal† to Lynchburg. Thence

1. *Via* Virginia Midland RR. to Washington, Baltimore, Philadelphia, Harrisburg, Pittsburg, etc.

2. *Via* Virginia Midland Railroad to Charlottesville, thence *via* Chesapeake & Ohio Ry. to Huntington and points on the Ohio River (by barge). The Ohio River markets will also be reached by the extension of the Buchanan & Clifton Forge RR.,† and a further extension of the Alantic, Miss. & Ohio RR.—At present (March, 1880,) the transportation of ores is limited to the James River & Kanawha Canal, with its railway connections at Lynchburg and tide-water connections at Richmond.

3. A branch of the Va. Midland RR. is, however, projected to pass through the Greenway tract, especially for the sake of the freights. By this means ores will be shipped directly to Pennsylvania and other northern markets, without the present detour by way of Lynchburg, and the necessity of trans shipment at that point.

4. Transportation by the James River Canal† is had to Richmond, and thence by sailing vessels to Atlantic ports. The completion of the projected Canal RR. from Lynchburg to Richmond will also give railway transportation to the same port.

5. A connection of the Buchanan & Clifton Forge RR.† with the Atlantic, Miss. & Ohio RR will also afford an outlet to Norfolk for coastwise trans-shipment from that port.

The following are the existing rates of transportation per gross ton of iron ore, as given me by Mr. Thomas Dunlap, General Manager of the Company.

To RICHMOND (*via* James R. & K. Canal.) Carting, canal tolls and boating	$1.60
To LYNCHBURG. Carting, canal tolls and boating	$1.10
Trans-shipment to cars (Va. Midland RR,)	.05
To PITTSBURG.	
1. From Lynchburg to Alexandria (*via* Va. Midland RR.)	$1.70
Thence by Pa. C. RR. to Pittsburg (@ $0.006 per mile)	2.21
	$3.91
2. From Richmond to Huntington, W. Va. (420 miles), *via* Chesapeake & Ohio Ry. and putting on boats on Ohio River	$2.50
Thence to Pittsburg by barge	1.00
	$3.50
To Baltimore, by sailing vessel of 200 to 400 tons, from Richmond	$1.00
To Philadelphia (summer)	1.25
To " (winter)	1.50
To New York, same as from Philadelphia	$1.25 to 1.50

A branch of the Va. Midland RR. as projected, to serve the iron ore industry of the James River belt, or the projected private narrow-gauge road of the Dover Iron Co. from Amherst—one or

*See Prof. McDonald's excellent study of the Greenway Belt; Semi-annual Report of Supt. Va. Military Institute, 1879. Reproduced in THE VIRGINIAS, Vol. I, p. 10, 1880.

†Now Richmond & Alleghany RR., in course of construction and at this time running trains from Williamson, on C. & O. Ry., eastward to Buchanan, and from Richmond westward to Columbia.—ED.

both—will open an all-rail and direct route to the north and west.

The several tracts of the Central Virginia Mining Co. comprise the larger portion of the so-called James River Iron Ore Belt, and practically the whole of the *developed* or even well explored portion of it. It is, moreover, a settled portion of the James River valley. The buildings upon the several tracts, including mansions, stores, shops and workmen's dwellings, contribute a large amount of useful personal property which would otherwise call for a considerable outlay. Convenient roads in sufficient number, including wood and county roads, obviate the necessity of any important outlay for that purpose.

The James River belt is the most easterly outcroping uplift of the crystaline or metamorphic iron ores of Virginia, and unlike some of the ores of the other iron belts of the Blue Ridge, seems not to be at all contaminated with the presence, in any considerable proportion, of titanic oxide.

Quality.—As will be seen by reference to the following tables of analyses, several ores have been brought to light and partially developed, which are superior Bessemer ores, others have very superior qualities for foundry iron.

Analyses of Iron Ores from the James River Ore-Belt.

No.	Greenway.	Metalic Iron.	Phosphorus.
1.	Greenway Mine, Vein XVI	66.32	0.035
2.	" "	67.79	0.019
3.	" "	65.63	0.035
4.	" "	69.86	0.034
5.	" "	63.62	0.016
6.	" " (No. I. Shaft)	68.978	0.028
7.	" "	66.622	0.022
8.	" "	64.84	0.049
9.	" "	65.80	0.037
10.	" Mean of above	66.608	0.030
11.	" Silicious portion	40.545	0.016
12.	G. W. Mitchell's prospect (6 ft, Dunlap)	66.650	0.015
13.	Harris tract, 3-5 ft. on wall	65.158	0.025
14.	"	61.12	0.088
15.	"	60.62	0.013
	Greenway Mine:		
16.	Average shipment for December, 1879	62.125	0.035
17.	Shipment December 19	69.28	. . .
18.	Hematite, Payne tract, No. I	53.01	0.135
19.	Magnetite, " No. III	69.71	0.25
20.	Specular, Coxe tract	62.63	0.06
21.	" Harris, No. I	65.62	0.029

(*Additional Ingredients in above Greenway Samples.*)

No	Silica.	Ferric Oxide	Manganous Oxide.	Alumina.	Lime.	Magnesia.	Phosphoric Acid.	Sulphur.	Titanic Acid.	Water.
1	3.29	95.24	0.09	0.53	0.04	0.07	0.08	.....	Trace.	0.66
7	3.96	92.002	.....	1.839	.....	.....	0.052	0.177	.....	.....
8	6.07									
9	6.36									
14	7.68									
15	8.87									
18	11.26									
19	7.87									
20	11.54									

Of the above Greenway ores, Thomas Dunlap *sampled* Nos. 1 to 5, 8 to 10, and 14 to 21, and J. P. Kimball Nos. 6 and 7, and 11 to 13, inclusive. Dr. F. A. Genth *analyzed* No. 1; the Edgar Thompson Steel Co. No. 2; the Bethlehem Iron Co. No. 3; Dr. C. P. Williams Nos. 1 and 2, and 16 to 21; Booth, Garrett & Blair Nos. 6 and 7, and 11 to 13; and the Cambria Iron Co. Nos. 8 and 9, and 14 and 15.—No. 7 was magnetic oxide of iron.

No.	Riverville and Wingfield.	Metalic Iron.	Phosphorus.
1.	Bed VI½	66.229	0.023
2.	" "	66.033	0.033
3.	" "	64.184	0.008
4.	" V	59.199	0.072
5.	" VI, Slope and drift	67.061	0.052
6.	" " " "	57.863	0.022
7.	" XI., Deep shaft, Wingfield	52.929	0.019
8.	" XIII., 3-ft. shaft, 35 ft	59.715	0.056
9.	" III., Prospect, 3 ft.	62.796	0.140
10.	" XIII., Deep prospect, 5 ft	52.929	0.084
11.	" VII., Hematite, 4 ft	52.262	0.946
12.	" III., Riverville	65.71	0.009
13.	" V., "	57.68	0.035
14.	" VI., "	65.71	0.046
15.	" VI½., "	66.61	0.016
16.	" " "	67.81	None.
17.	" XIII., "	66.90	0.016
18.	" " "	63.34	None.
19.	" X½., Wingfield	52.98	0.23
20.	" XI.	57.30	0.30

(*Additional Ingredients in above Riverville and Wingfield Samples.*)

No.	Ferric Oxide	Manganous Oxide.	Alumina.	Lime.	Magnesia.	Silica.	Phosphoric Acid.	Sulphur.	Titanic Acid.	Water
1	94.613	None.	None.	Trace.	.....	4.370	0.052	None.	.....	.....
12	90.74	0.11	4.43	0.29	0.12	4.10	0.02	.....	0.15	0.04
13	82.38	0.32	1.96	0.23	0.06	14.67	0.08	.....	.....	0.12
14	91.39	0.17	4.20	0.20	0.15	3.04	0.11	.....	1.10	0.64
19	75.69	0.29	3.76	1.29	0.25	16.60	0.54	.....	0.18	1.40
20	81.86	0.20	3.06	1.38	0.18	11.32	0.70	.....	0.22	1.08

Of the above Riverville and Wingfield samples Nos. 1 to 11 were *sampled* by J. P. Kimball and *analyzed* by Booth, Garrett & Blair; and Nos. 12 to 20 were *sampled* by Thomas Dunlap and *analyzed* by Dr. F. A. Genth.—Nos. 12 to 14 were ferrous oxide.

No.	Stapleton.	Metalic Iron.	Phosphorus.
1.	Cherry Tree	54.65	0.29
2.	Manganiferous Vein	51.65	0.25
3.	6-ft. Vein	46.09	0.10
4.	Stapleton Cliff	47.20	0.32
5.	Lee Cliff	60.67	0.40
6.	Lee Red	56.00	0.06
7.	Stapleton, XVI	67.73	0.009
8.	Kent	59.92	0.001
9.	Stapleton, XVI., 2 ft	67.138	0.008
10.	" XII., 2 ft	50.360	0.087
11.	Maude	62.796	0.099
12.	" 2–3 ft	64.235	0.111
13.	1½ ft., Prospect	58.120	0.099
14.	Tinsley Manganiferous	22.57	0.08
15.	Maude, average shipments Jan. to March	63.43	0.06
16.	" individual boat load	66.54	. . .
17.	" " "	68.72	. . .
18.	" " "	69.80	. . .

Of the above samples, No. 14 contained 54.669 manganous oxide,—34.56 manganese. Nos. 1 to 8 and 14 to 18 were *sampled* by Thomas Dunlap and *analyzed* by Dr. C. P. Williams; Nos. 9 to 13 were *sampled* by J. P. Kimball and *analyzed* by Booth, Garrett & Blair.

Application.—(1) These ores especially commend themselves to furnaces within easy reach of the Atlantic sea-board. (2) Facilities are already established, as above shown, for laying down these ores, by competing lines, at Pittsburg, and for the supply of furnaces in the Ohio Valley, thus meeting the Lake Superior and

Missouri ores, which are of about the same general type, and in competition with which, if properly mined, they will suffer neither as to quality nor transportation. The two ores will thus share the same conditions of the market, and probably be valued very near together.

(3) These ores are already available, *via* the Chesapeake & Ohio Ry., for mixture with the siliceous hematites of the ore-belts west of the Blue Ridge, and the coal and coke of Fayette and Raleigh counties W. Va. By the completion of the Buchanan & Clifton Forge Railroad and its extension to an intersection, as projected, with the Atlantic, Miss. & Ohio RR., or by the completion of the Richmond & Alleghany RR. through the valley of the James to Clifton Forge, they can be smelted either with New River coke or Kanawha (W. Va.) block coals, like those of Campbell Creek.

The cost of delivery to the canal, or on board cars, will depend, in every case, on the distance of the mine from the means of shipment. Ores may be delivered by one set of operations at Riverville, at the canal, by adits opening directly upon the canal. An extensive series of ores is accessible by the same adit. A choice will doubtless be found in them, and all cannot be expected to be up to the standard of a shipping ore. In the case of a majority of the mine openings, the delivery will have to be by tramways branching from the established system of transportation, whatever it may ultimately be.

Capacity and Production.—The capacity of either of the three tracts above described, or all of them, will be in direct proportion to the extent of the development both in mining and transportation. The output of the Greenway mine, as at present operated, is some 50 to 75 tons a day. This can readily be increased to over 100 tons by additional hoisting capacity, combined with a development well advanced beyond stoping ground. On the completion of the adit and cross-cut, so as to connect with the shaft some 90 ft. in depth, an additional means of delivery will be opened, and thus the production increased. The production of the Riverville and Stapleton tracts is at present each about the same as at Greenway. The old mine, formerly wrought for the supply of the Powhatan Furnace, has been re-opened and is delivering a high-grade ore unexpectedly low in phosphorus. With ample development by drifts for stoping either above or below water level, these tracts, as well as the Greenway, will yield accordingly.—With an adequate outlay the three tracts can be simultaneously developed to a production of 500 tons a day within one year. A still larger production could be obtained if forced beyond the working estimates elsewhere given.

Everything goes to show, however, that several deposits on each tract are *par excellence* rich and non-phosphated ores, and it therefore only remains to identify and select these for development, and to lay out the immediate improvements with especial reference to these. The present output of the three tracts is about 150 tons a day of high-grade ore, used exclusively for Bessemer metal.

With improved transportation, such as is already projected, a good business may also be done in ores for foundry iron,—a large variety of very rich ores of this class, as already shown, occurring within each of the above described tracts. The limonites along the limestone contacts are especially suited for car-wheel iron, the old Powhatan Furnace having fully established their excellence for this purpose. JAMES P. KIMBALL.

Bethlehem, Pa., March 15, 1880.

The average prices of pig-iron per ton, at Glasgow, Scotland, from 1870 to 1879, inclusive, were as follows: $13.56, $14.50, $25.50, $29.25, $21.75, $16.25, $14.50, $13.50, $12.50, and $12.50; an average of $17.38. Add to these prices the cost of ocean transport and you have the cost of good foreign iron in the "long run" delivered in this country.—Iron can be made at numerous points in Virginia, as we have repeatedly shown, counting all the items of cost, interest, sinking fund, taxes, etc., included, for $13. per ton as a maximum. Comment is unnecessary.

The Pennsylvania Mining Co. has purchased the John J. Dillard farm, in the James River ore-belt, near Riverville, Amherst Co., Va., for $40,000, says an exchange.

NEW RIVER IMPROVEMENT.—Col. Wm. Proctor Smith in charge of this work in W. Va., has completed the work at the mouth of Indian Creek and is now completing that at Harvey's Falls.—*Greenbrier Independent.*

VIRGINIA CROPS IN 1880.—On 18 acres of sod land, Wm. Myers, in Rockbridge County, raised 1226 bushels of corn; 68 bushels to the acre.—*Gazette.*

Low Moor Furnace.—Our last report from this leading Virginia furnace (p. 181 of 1880 Vol.) was to Dec. 11.—For the week Dec. 12-18, the 65-71 days of present blast, about 680 tons of iron of various grades were made, from some 502 tons of lump and 1,015 tons of wash ore, with about 750 tons of coke, 63 of coal, and 707 of limestone.—During the part of week Dec. 19-21, the 72-74 days of blast, the run was only 3 days, as the furnace was banking down for the holidays; about 203 tons of pig were made from some 110 tons of lump and 221 of wash ore, with 350 tons of coke and 154 of limestone.—The very unusual severity of the weather for this latitude, made it difficult to have the labor performed necessary for such an establishment as this during its continuance, so the furnace was "banked" from Dec. 21 to Jan. 6. For the part of a week, Jan. 6-8, 1881, the 75-77 days of the blast, merely getting under way again, the make was some 83 tons of pig, from about 273 tons of lump ore, with 233 tons of coke and 177 tons of limestone.—In the week, Jan. 9-15, the 78-84 days of present blast, it made about 630 tons of pig iron, mostly "mill," using some 500 tons of lump and 1,000 tons of wash ore, 763 tons of coke and 631 of limestone.—During the week, Jan. 16-22, the 85-91 of present blast, the make was near 566 tons, divided between "mill" and "foundry," from some 482 tons of lump and 963 of wash ore, 735 tons of coke and 651 of limestone.

The amount of iron made in 1880 was about 4,600 tons, 4,000 of which were marketed in Cincinnati; the average number of men employed was 250.

A Blake "crusher," that can break 175 tons of limestone a day, is nearly completed, at the quarries about half mile from the furnace by the company's railroad. It now has 83 coke ovens in blast, making about two tons in 48 hours to the oven, with a yield of some 63 per cent of coke for the coal used; 40 ovens are drawn one day and 43 the next; 20 more ovens are about ready for use.

By a freak of the types we were made to say in the Dec. No. that Low Moor had sold 20,000 tons of iron when it should have been 2,000.

The Longdale Iron Co., Alleghany Co., Va., made in 1880, at its Lucy-Selina furnace, from the best information we can gather, about 8,370 tons of hot-blast, coke pig iron, all of which was marketed west, to Cincinnati, Keokuk, etc. It is well known that this company generally uses less than a ton of coke—made at its Sewell mine on the C. & O. Ry., W, Va.—for a ton of iron, so we may put it down that it used about 8,300 tons of coke. As the run of the limonites of Brushy mountain will yield from 46 to 49 per cent, it probably used some 18,000 tons of ore, all obtained from its own beds about 4 miles, by rail, from the furnace. The limestone used—No. VI or Lower Helderberg, from its own quarries, less than 2 miles, by the company's railroad from the furnace—was probably about 4,000 tons, as its ores are low in silica. Some 200 laborers are employed in mining and furnace work.—The furnace that did the above work is described by Mr. H. Firmstone (Trans. Am. Inst. M. Eng., Vol. VII, p. 94) as "60 ft. high and 11 ft. diameter at the at the largest place, which is about midway of the height; the tunnel-head is 8 ft. diameter, and the furnace is filled by a modification of Coignet's charger (or double bell), the gas being taken off by a central pipe. The hearth is 6 ft. in diameter, and has 3 tuyeres. About 3,700 cubic ft. of blast per minute is supplied to the furnace, at 3.5 lbs. pressure per square inch, the temperature of the blast being a full lead heat, rarely melting zinc"——"The cubic contents of this furnace is about 3,900 cubic ft."——"It produces about 185 tons of iron per week."—In this connection it may be well to put on record some analyses of the materials used at this carefully managed furnace.—A sample of the *iron ore*, analysed by Britton, we believe, yielded, pure metalic iron 54 70, oxygen with the iron 23.14, water 12.67, insoluble siliceous matter 3.14, alumina 1.28, protoxide manganese 2.46, lime 0.18, magnesia 0.08, alkali, etc., and loss 1.58, sulphur a trace, and phosphorus 0.215.—The Sewell coal, analysed by Britton, contained, carbon 72.32, volatile matter 21.38, ash 5.07, sulphur 0.20, and water 1.03; and its *coke*, carbon 93.00, ash 6.73, and sulphur 0.27.

"**Bituminous Coal**, I find from actual tests, is more econominal than anthracite.—The only true test of economy in fuel is to find out what coal gives the largest amount of heat for the smallest possible cost;—what fuel will evaporate the largest number of pounds of water into steam for a dollar's worth of fuel." A. F. Upton's address on the Jarvis Furnace before the New Eng. Cotton Mfrs. Ass'n.

Richmond & Alleghany RR.—Farrish, Randolph & McKendree, who have contracted to make the 24 miles of this road from Lynchburg up to Rope Ferry, advertise for 1,500 laborers, including 25 blacksmiths and 50 carpenters, for immediate work.—*Lynchburg Advance*, Jan. 31.

RAMIE AND JUTE are now successfully raised on the land of R. E. Lee, near West Point, Va., by A. M. Elphinstone. It is proposed to manufacture articles from the fibre of these plants at that point.

SUMAC.—At Petersburg, Va., three million pounds of sumac leaves, valued at about $25,000, were consumed by a fire, Dec. 8, supposed to have been caused by spontaneous combustion.

Diatomaceous Sands of Richmond, Va.

By Martin Coryell.

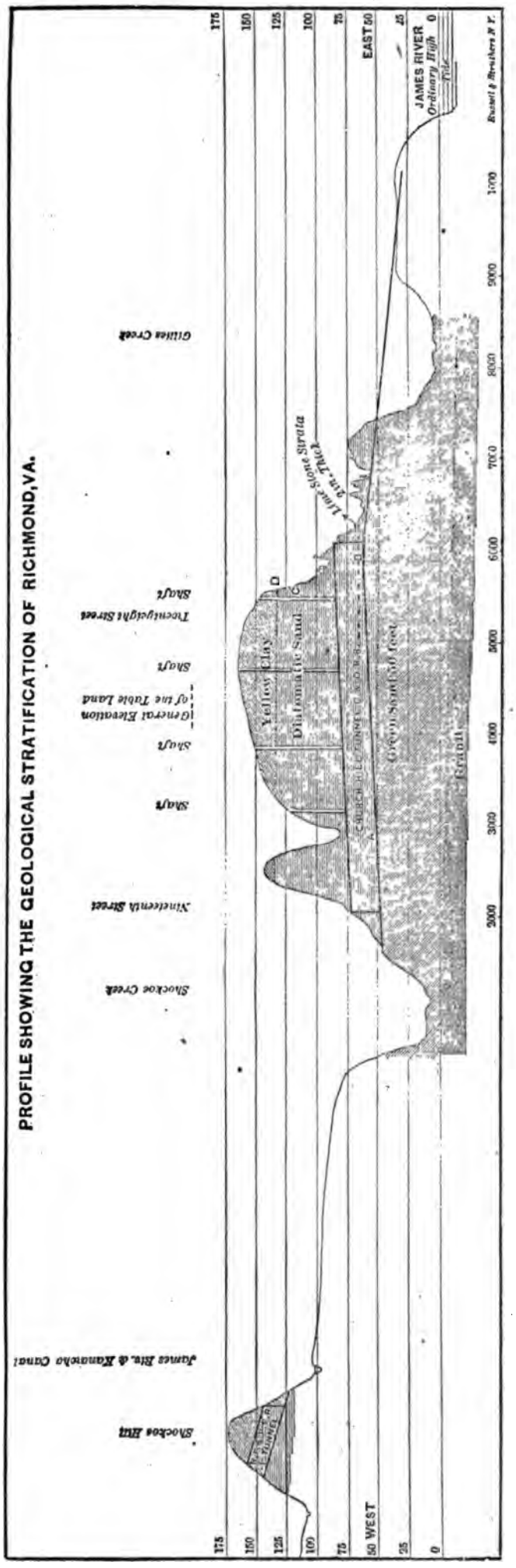
(Proceedings of Am. Inst. M. Engs., Vol. IV, p. 230.)

Ehrenberg was the first to publish and direct attention to the peculiarities of the diatomaceous deposit of Richmond, but how and by whom he was supplied with the material for his microscopical investigations, is not generally known, but we may presume W. B. Rogers, formerly State Geologist of Virginia, furnished the material, and may have given the geological position or horizon. Of these facts we have no available evidence, nor have we any estimate of the thickness of this stratum of diatomaceous or infusorial earth.

At the request of a member of this Institute, I have investigated the subject, and offer the following facts as the result, derived principally from information supplied by Mr. John Ott, of the Southern Fertilizing Co., Dr. Wm. Taylor, State Chemist, C. Peticolas, microscopist, Capt. Ro. H. Temple, civil engineer, Maj. C. M. Bolton and Mr. C. M. Smith, civil engineers, and formerly engaged in constructing the tunnel under Church Hill, in Richmond.

The city of Richmond is generally described as being built on seven hills. This is not the fact, geologically speaking. Originally there was an immense plateau of land, about 200 ft. above tide, in which a deep excavation was made from the west to the east by the James River cutting down to the granite. Opening southward and meeting the valley of the James are various ravines and gullies, in the principal of which are Shockoe and Gillies creeks. The formation is Tertiary, subdivided into all the classified divisions, but at the present moment no one has been found to make this section a special study. Rogers' early classifications and diagrams, with all their imperfections, are the only published records and the printed editions were long since exhausted. The city of Richmond is really situated in these ravines of the James, Shockoe, and Gillies, and their connections. The profile marked A, Plate V, represents the section of the plateau as exposed in making the tunnels and railroad cuttings through the city of Richmond, and it will be observed that 30 ft. of the top stratum, as found further inland, is denuded. The tide flows up to the granite ridge which makes the rapids, not only of the James River but also of the Delaware, Schuylkill, Potomac, and many other rivers emptying into the Atlantic.

At Rockets, near the terminus of the Chesapeake & Ohio Railway, the tide covers the granite some 13 ft.; near the mouth of Shockoe Creek the rock comes to the surface and forms the bed of the river, and thence rises rapidly to the west, about 120 ft. above tide in the distance of 10 miles. It has a descent of about 80 ft. within or adjoining the city limits, and is capable of furnishing power to an enormous extent. On the sides and bed of the river are the valuable granite quarries, furnishing stone used in the public buildings of Washington and other cities, and the theory of deeper and deeper disintegration of rocks in the Southern States as compared with the Northern, as set forth by Dr. T. Sterry Hunt, is fully exemplified in this section along the James River. Upon this granite bed is a sandy clay some 50 ft. thick, of various colors and composition, then a ferruginous sand, so compact in places as to resist the pick and crowbar, and which, when struck, produces sparks of fire, and is classed with the rocks. Upon this stratum is the blue deposit through which the tunnel was made. The thickness of the stratum in the tunnel was found to be 80 ft., and the color, when first exposed, a dark blue, but on long exposure becoming nearly white. Upon this a yellow clay, very distinct in color and filled with water-worn silicious boulders, nearly the size of hens' eggs. This stratum is 30 ft. in thickness, and upon it are various strata of clays which make the soil of the upland country, and under present cultivation do not indicate much fertility. In excavating the tunnel, large quantities of bones and teeth were found, not interspersed through the material but generally in pockets. The workmen, observing the interest manifested at the finding of the deposit and the anxiety to secure every relic, conceived them to have a money value, and did not fail to appropriate all the fine specimens. Subsequently, not realizing pecuniarily as expected, they neglected and permitted to go to waste, what would have been highly prized cabinet specimens.



(A number of specimens, obtained by Mr. C. M. Smith, were then exhibited, consisting of fish remains, vertebrae and teeth, coprolites, etc.)

The microscopic slides were prepared by Mr. C. L. Peticolas, from materials obtained from different localities, such as

Church Hill, French Garden, the Capitol grounds, etc. These localities yielded the most satisfactory and interesting specimens for the microscope, but failed to give the geological horzon or thickness of the strata containing the diatoms.

Mr. Peticolas, recognizing the importance and value of the true position and thickness of the strata from a known baseline, very kindly devoted his time to establish these facts for this paper, and, with the knowledge and assistance of Maj. Channing M. Bolton, he was furnished with material from well established points in the tunnel and the railroad excavations, marked on the profile A, B, C, D.

To the eye, there is a uniform stratum 85 ft. in thickness, blue in color when first exposed, and becoming nearly white after long exposure, this was generally denominated the diatomaceous stratum. Material from the bottom of the tunnel and lower portion of the blue stratum (A. and B.) was nearly barren, and the remains of an inferior type; at the point C diatoms were found in great abundance, and at D, near the top, the clay was quite barren. These results were not entirely unsatisfactory, but time did not permit us to extend the observations farther; investigations will be continued, however, in a systematic manner, and will doubtless prove instructive and useful.

This diatomaceous sand, or infusorial earth, has been known a long time, and its extent is, undoubtedly, large, yet it has not been utilized or made profitable although there is no reason to doubt that a proper preparation by washing will make it of commercial value as a polishing powder, or for the manufacture of dynamite explosives.

Rich-patch Iron Region.

Notes on the Kayser Property.

Maj. Hotchkiss—In compliance with a promise made to my friend, D. A. Kayser, Esq., of Staunton, allow me to add a few notes to what is said in my report on the Rich-patch region, published in The Virginias for Dec., 1880, about his property. There are a few points that merit a rather more distinct notice than I was able to give them in a report coverrng such a wide field of observation.

Mention was made of an extensive bed of limestone on this land, cut by the R & A. RR., just where it passes out of the gorge of Rich-patch at its southern extremity. This is part of the same formation (Helderberg, 7), quarried at Callie Furnace and at Roaring Run. It doubtless extends throughout the length of this property so far as it skirts the base of the mountain, though obscured through the greater part of the distance by the overlying bed of the iron-bearing Oriskany formation (8), and by the debris from the mountain. It could be easily quarried, however, right at the side of the railroad, where it is about 180 feet thick, and would yield, if properly assorted, an abundance of good material for furnace flux and for the manufacture of lime. Among its numerous beds is one of fossiliferous marble, full of encrinites and shells, very much like the marble quarried at Craigsville, in Augusta, and of the same geological age.

The ore on this property has been exposed to view a short distance from the railroad, where it promises well both as to quantity and quality. At several openings still nearer the road there are indications that point to a bed of considerable extent, but never fully opened. If a tunnel or deep cut were run into the base of the mountain at almost any point in this region, and *at right angles* to the general trend of the range, it would ultimately cut both the ore and the limestone. At this point the bearing of the main mountain is not far from N. 50° E. and the outcropings of the ore and limestone beds have about the same range—the limestone being nearer the mountain than the ore. Hence, to cut the beds at right angles, the line of approach should be N. 40° W.

Another item of value on this property worthy of notice, within a very convenient distance of the railroad, is a large area of excellent timber, including pine trees suitable for lumber, and tall, straight young white-oaks in great numbers, that will yield a large number of superior railroad ties.

This property is traversed by several wagon roads of good grade, by which its mineral and forest products can be easily transported to the adjacent railways.

Notes on the Robertson Tract.

At the request of some of the parties interested in this property, I wish to add something to what was said in my general report. This is an extensive tract, mostly of mountain land, lying along the N. W. face of the Rich-patch range, and south and southeast of Covington, Alleghany county. Besides being contiguous to Jackson River and Potts Creek, it has several streams running down from the mountain, such as Hays Run, Mill Branch, &c., as seen on the map, affording abundance of water for washing ores and for other purposes. These streams, as well as others farther east and tributary to Karnes Creek, have cut deep ravines in the ridges from which they descend, and in others through which they pass, so as to expose in many places the three important beds of ore that are found so well represented here—the heavy brown hematite of 8, and the fossil and red-shale beds of 5 a. b. c. These are all limonite ores, but differ considerably in texture and composition. The chief impurity in the ore of 8 (VII Rogers) is silica, while in the fossil and red-shale ores, clay, with a considerable percentage of carbonate of lime, constitutes the leading foreign substance. Actual experiments at different furnaces has proved that these varieties of ore work to great advantage when mixed.

As to the quantity it is enough to say that the beds of fossil and red-shale, as shown by my several sections (Dec. No.), run the whole length of the property, and as far as they are well exposed, range from two to five feet in thickness, while the heavier bed of hematite (8) has exposures ranging from 20 to 50 in thickness. Limestone in abundance accompanies this ore at almost all points.

There is a great deal of valuable timber, especially along the borders of the streams that run down from the mountain, from which railroad ties, building and fencing lumber can be made to an almost indefinite extent.

Yours truly,
J. L. Campbell.

W. & L. University, Jan'y, 1881.

The Rich-patch Report.—Note by Prof. Campbell.

In my general review of the S. E. slope of the main or east Rich-patch ridge, an omission occurs which might cause a casual observer to suppose that in sections Nos II and III (December No. p. 189) a wrong position had been given to the beds of ore and limestone. In the sections they are nearly vertical, but with a very steep dip towards the S. E. This is their normal position along the greater part of the range, but there are several local inversions in rather conspicuous places, that make these beds appear to dip beneath the mountain, *i. e.* towards the N. W. Such is the case at Callie Furnace, and as far towards the southwest as the border of Capt. Cook's property, where a bed of Helderberg limestone dips N. 60° W.; and if its geological relations did not forbid such a conclusion, it might be supposed to pass beneath the mountain.

Several like inversions of the beds of 5 c. may be observed in the cuts of the railroad between Callie Furnace and the mountain. There are two ways of accounting for these abnormal tiltings of the strata. (1) They may have been crushed folds, or wrinkles in the strata, produced at the period of the up-thrust of the mountain range, and tilted towards the southeast; or (2) they are, more probably, the result of the heavy pressure of the immense masses of rocky material that once covered the face of the ridge above them, and that gave the strata something of the motion of an incipient land-slide—only enough to produce inversions, but not enough to produce any very great displacements. Thus the order in which the beds overlie one another has been apparently reversed for moderate distances, as indicated by their out-croping edges; while at other points along the face of the ridge (and no doubt everywhere at greater depths than are now within our reach) they all resume their usual order of succession, and their normal dip.

J. L. Campbell.

W. & L. University, Jan'y, 1881.

Cumberland Coal Trade.—From Jan. 1st. to Oct. 16th. 1880 the B. & O. RR. carried to market 961,492 long tons of this coal, as against 673,156 for the corresponding period of 1879. The C. & O. canal took 497,979 tons in 1880, and 353,607 in 1879.—*Coal Trade Journal.*

Geological and Mineralogical Explorations in Virginia, things almost unheard of a few years since, are now becoming quite common, as former issues of THE VIRGINIAS show. Dr. J. P. Kimball, of Lehigh University, Bethlehem, Pa., has been for some time carefully exploring a portion of the James River Valley (we found him there last November.) By his courtesy we present to our readers in this number an excellent and very suggestive illustrated paper on the "Greenway iron-ore-belt," of that valley; a paper of present practical and scientific interest, not only because of the quite large out-put of the ores it describes at this time, for local use and for shipment to other states—an out-put that will doubtless be largely increased now that The Republic Iron Co. has fixed the price of its Lake Superior ores at $10 the ton for 1881, at Cleveland, a price the other companies of that region will probably adopt, and of the view of so eminent a mining engineer and geologist in reference to the geological structure of that region of which so little is known and nothing settled, but also for the conclusions that may be drawn from it in reference to the probable extension of the same belt for long distances to the N. E. and S. W. from where it has already been developed,—for we believe that such extensions do exist. We are greatly obliged to Dr. Kimball for this timely contribution, and hope he will favor us with the results of his further observations.

We are much pleased to hear from our faithful friend, Prof. J. L. Campbell, so much of whose recent work has appeared in our columns, (work that declares its own intrinsic excelence) that he will spend the coming summer in a detailed examination of the portion of the of the James basin, from Richmond up, that is tributary to the Richmond & Alleghany R R., working up its geology and mineralogy, and preparing a report on its mineral resources; in fact adding to and in a manner completing the work he so well began in a paper on a part of the same region that appeared in THE VIRGINIAS for Jan. 1880. It is especially gratifying to be able to state that this work is done at the request and cost of the Richmond & Alleghany R. R., the clear-headed management of which, in this as in other things that could be named, has the sense to understand that the basis of substantial material development is scientific knowledge wisely applied. We trust that this enterprising corporation will publish this report, with maps and sections, in a style worthy of -we may say in advance--its merits. "It is a plucky thing," as an Englishman would say, in Prof Campbell, to march down from The Valley and its mountain ramparts, and boldly attack the Archaean problem; but then, having captured that Valley and its mountains, "section" by "section," he doubtless has been longing to add the next region to his conquered domain. We hope to have the results of this campaign.

From correspondence on page 10, it will be seen that Prof. Wm. M. Fontaine, of the University of Virginia, will, with his geological class, commence the explorations which were announced in THE VIRGINIAS for Nov. 1880, in a letter from the Rector, the Hon. A. H. H. Stuart, at Waynesboro, where the Chesapeake & Ohio Ry. crosses the Blue Ridge, and extend them along the eastern side of the Valley, southwest, to the water-gap of the James in the Blue Ridge, a stretch of about 45 miles, that will be traversed by the Shenandoah Valley and, in part, by the Richmond & Alleghany railroads during the present year. We have already published geological papers with sections, by Prof. Campbell, on the S. W. portion of this region, but there remains a fine field for exploration from Rockfish gap to Tye-river gap. Prof. Fontaine himself has published (in the American Journal of Science) an elaborate paper on the rocks at Rockfish Gap, but it does not speak to the eye through a map and section, and does not recognize sufficiently the economic element. We are much gratified to learn that work will begin there, and we hope this important section will be carefully *measured* and *projected*. Recent trial pits in the iron ores and railroad cuttings, will greatly facilitate explorations on that line, We sincerely hope that Prof. Fontaine will begin at Shadwell, in Albemarle, and give us a reliable section entirely across Piedmont, from the eastern base of the Coast range, to and across the Blue Ridge to South river at Waynesboro, reducing to order the attempt at a section on the same line, that appeared in Rogers' preliminary report, and give us the proper place and geological relations of the great iron ore belt hitherto undeveloped, that runs through Piedmont, somewhat midway between the Coast range and the Blue Ridge. Such a section is today more wanted than any other in Virginia. If Prof. Fontaine would give us this one, Prof. Campbell one from near Riverville, on the James, across Piedmont by way of Amherst C. H. to near the mouth of Irish creek, in Rockbridge, and Prof. Ordway and his class from the Massachusetts Institute of Technology, as suggested in the letter from Col. Ott, on page 10, gentlemen our people would be glad to welcome to Virginia and furnish all the aid in their power, would make an intermediate one, say from the mouth of Tye river, at the James, across by way of Lovingston, and over the great salient of the western Blue Ridge, in Augusta, to near Greenville, we are satisfied that substantial progress would be made, not only in solving the question of the structure of the Archaean over a considerable area of Central Virginia, where the conditions are extremely favorable for such a solution, but also in establishing the place, relations and extent of what we are inclined to think will yet become one of the important sources of iron-ore supply in the state.

The Coal and Coke Movement over the Chesapeake and Ohio R'y, for the month of December, 1880, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Charles M. Gibson, the Fuel Agent for the company, were as follows:

	1879.	1880.
Fuel for use of Company	6,347	12,510
Shipped at Huntington on the Ohio river	12,373	4,359
Delivered on line of road west of Richmond	2,995	14,234
" at Staunton to Valley RR	26	167
" Charlottesville to Va. Mid. RR	2,501	5,300
" Gordonsville to do do	298	56
" Hanover Junc. to R. F. & P. RR	941	927
" Richmond for consumption, including steam-tugs and dredges	4,003	4,301
Delivered to E. Lex & Big Sandy RR	.....	546
Shipped at James River wharves	13,948	17,960
Total	43,432	60,360

The increase in the total movement in Dec., 1880, was 39 per cent over that for Dec., 1879. The movement was somewhat less than in Nov., 1880, owing to the holiday season and especially to the unusual depth of snow and severity of the weather that characterized the month, hindering railway operations. The large increase in the item "delivered on line of road west of Richmond," an increment of nearly 380 per cent, is in consequence of the demand for fuel for the furnaces put in blast along the road in 1880.

The character of the fuel moved during the same periods, is shown in the following exhibit:

	Cannel	Splint & Bits.	Coke	Total.
For the month of December, 1880	764	58,566	78[illegible]	60,360
" " " 1879	3,521	38,251	1,660	43,432
Increase, 1880	.....	15,6.5	4,070	16,928
Decrease, "	[illegible]	.....	.....	.....

The increase in movement of splint and bituminous coals was over 90 per cent, in consequence of blast-furnace demands.

The Coal and Coke Movement over the Chesapeake & Ohio R'y, for the years 1879 and 1880, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Mr. Charles M. Gibson, the Fuel Agent for the Co., were as follows:

	1879.	1880.
Fuel for use of Company	83,916	122,287
Shipped at Huntington on the Ohio River	77,662	105,899
Delivered on line of road west of Richmond	29,650	57,598
" at Staunton to Valley Railroad	369	716
" at Charlottesville to Va. Mid. Railroad	36,811	41,106
" at Gordonsville to do. do.	1,142	1,033
" at Junction to R., F. & P. do.	4,781	13,625
" at Richmond for consumption, including steam tugs and dredges	52,976	47,043
Shipped at James River Wharves	174,526	216,809
To E. L. & B. S. RR		878
Total	451,833	606,444

The character of the fuel moved during the same periods, is shown in the following exhibit:

	Cannel.	Splint & Bits	Coke.	Total.
For the year 1880	43,080	526,990	36,374	606,444
" " "	33,261	395,509	23,063	451,833
Increase	9,819	131,481	13,311	154,611

The increase in cannel was 29 per cent, in splint and bituminous 33, in coke over 57, and in the total movement over 34 per cent.

The Callie Furnace Property.—By Prof. John M. Ordway, of the Massachusetts Institute of Technology, Boston, Mass.

NOTE.—The following letter was written to some gentlemen in New York, at whose instance the examination was made by Prof. Ordway; it was made public, but not in a permanent form; we print it now as a valuable portion of the mining literature of the Rich-patch region, coming, as it does, from the metallurgical professor of the technical school presided over by Prof. Wm. B. Rogers.—ED.

After a hasty inspection of the iron ore beds near the Callie Furnace, on the southeastern slope of the Alleghanies, in Virginia, we went again on the 29th of August, to make a more careful examination. The favorable impression of the first visit was in no wise diminished by this closer study of the deposit. Openings enough have been made, to show that the bed extends a considerable distance to the northeast and southwest, but the single day allotted to the work gave us time to trace the outcrop ourselves only about half a mile. In this space loose and partly imbedded lumps of ore are scattered all over the mountain side as far up as a line running along some two or three hundred feet higher than the bed which has been opened. The occurrence of surface ore above the worked bed is a pretty sure indication of the existence of a second bed overlying the limestone which itself overlies the main bed; but no excavations have as yet been made to ascertain the thickness of this upper layer or to demonstrate to an absolute certainty the existence of such a bed.

The stratification of the rocks at this place is rather puzzling, for the ore bed with the black shale below and the limestone above, has been exposed so far as to show plainly that they all dip to the west at an angle of over sixty degrees with the horizon, while the magnificent section of the rocks shown in the Jackson River gap at Clifton Forge, would lead one to expect a moderate eastward dip, the gap being only three miles off. The only explanation of this paradox, that occurs to me after our short exploration, is that the strata have been folded and tilted beyond the perpendicular, and thus what was originally overlying now appears beneath. However this may be, the rocks have certainly undergone a great dislocation at this spot; and whenever the disturbance of the strata is so great, there is a little uncertainty as to the continuance of the ore to a great depth. But we need not borrow any trouble from the distant future, even if it were certain that the yield of ore would be lessened in the next century. The supply is abundant for the present generation. Successful mining operations carried on to the north, northeast, west, and southwest, not many miles distant, in the same mountain range, would seem to justify the belief that the rich show of ore at the Callie Furnace, is no narrowly limited patch or pocket.

The main bed we made out, by a rough measurement, to be at least 150 feet thick. It consists of ore in large and small masses very irregularly distributed in clay, and it greatly resembles the valuable iron ore deposits in western Massachusetts. The position of the beds with reference to the valley below will render the mining of the ore very easy for a long time to come. Still to insure economy of fuel in smelting, the ore should be carefully picked and the clay should be gotten rid of by washing. This involves a slight additional expense, and I am inclined to think that two dollars for the ore and limestone for a ton of iron will prove to be too low an estimate It is by no means so easy to pick out in the mine itself what will fairly represent the utilizable ore, as it would be to take an average from a heap of ore after it is taken out and washed. But there being no large lot of washed ore on hand, it was necessary to make an impartial selection of numerous pieces, and to consider the ground up mixture as showing the practically attainable degree of purity. This supposed average of unwashed and unroasted ore from the largest opening is found to contain 46.8 per cent. of metallic iron. So to secure the material for a ton of pig metal it is necessary to mine about two tons of good ore, together with the surrounding rubbish, amounting perhaps to another ton. To turn over and throw away this rubbish involves some labor. The handling of three tons of stuff as it comes, the picking out and roasting of the available portion, and carrying it to the furnace may be done probably for not over three dollars; but two dollars I think is a rather low estimate. The bed is thick and easily accessible, there is little or no blasting to be done, a tunnel driven in at a lower level drains off the water, weshing and picking can be done without much machinery and by a few hands, roasting, though advantageous, is not necessary, and the carriage to the furnace mouth involves no uphill carting.

With ore of so good quality and a rightly equipped furnace, one ton and a quarter of coke should make a ton of forge iron. With a Blake's Crusher to crack the limestone obtained from the bed overlying the ore the cost of flux will be very exceptionally low. Heretofore coke has cost altogether too much on account of the want of a healthy competition in its manufacture. I see no good reason why it should not be bought in the New River region for not over two dollars per ton, as soon as the new mines near Mann's Creek are fairly opened. Now what ought a ton of iron to cost, supposing the furnace with its appurtenances to be enlarged and improved so as to turn out 20 tons per day, and a tramway to be built to the railroad at Clifton Forge?

2 tons Iron Ore, @ $1.50 per ton,	$ 3 00
1¼ tons Coke, at mines, $2.50; C. & O. freight $1.88; Callie RR. freight 31 cts.; cost at furnace,	4.69
Labor,	2.00
Wear and Tear, and Interest,	2.00
Incidentals,	.50
Freight to Clifton Forge, (to Ches. & Ohio R'y)	.25
Freight to Huntington, W. Va., by Ches. & Ohio R'y	2.35
Commission for selling,	.50
Total cost delivered on Ohio River,	$15.29

Iron can be made elsewhere at so low a rate only in those few localities in which the coal and ore occur together, and in such places it is rare indeed to find coal of such excellence as the New River, upper (lower?–ED) coals. Seeing how many furnaces are now out of blast because they cannot afford to manufacture at the present low rates in the trade, we may safely say that good iron is likely to command hereafter not much less than $20 per ton.

I have not the requisite data for calculating the cost of a tramway from Callie Furnace to Clifton Forge, and therefore cannot reckon the interest with nicety. But the road would suffice for something more than the carriage of 20 tons of pig iron and 25 tons of coke per day. The interest account should be paid by the sale of ore itself, or else the production of iron should be largely increased. But instead of selling 40 tons of iron ore at a profit of say $40, it would evidently be better to make this ore into 20 extra tons of iron at a profit of $80 or more, provided there were capital enough at command to erect another furnace. In other words the question arises whether in order to make the most of a road that is essential to the prosperity of Callie Furnace, it were better to use that road for transporting ore to be sold to another company or to increase the fixed capital of the Callie Furnace owners and transport a manufactured product.*

But it is much easier to carry a ton down hill than to haul it up a steep grade, and I believe there would be advantages in carrying down ore and limestone to the river valley and making the iron there. A good furnace site beside the Chesapeake and Ohio railway can no doubt be bought for a very moderate sum. With ample grounds secured for future furnaces, and with the proposed tramway built, it seems to me that the Callie Furnace property will be far more valuable than that of other companies now in successful operation, in that section of the country.

The tramway from the mine to the railroad is obviously a matter of prime necessity. But we did not have time to go over the exact route proposed, and I cannot therefore give any estimate of the probable cost of such a road. The general character of the wagon road from Callie Furnace to Clifton Forge would not lead one to anticipate any difficulty in grading the road as far as the Jackson River gap. Getting round the precipitous face of the gap and bridging Jackson River will necessarily cost no small amount of money. And before the work is commenced it would be well to have careful surveys made so as to select the best possible route. In order to get a just basis for calculation it would be well to get a full survey made and then see how many tons of freight must pass over the road per day in order to make a reasonable allowance for tolls to pay the interest on the cost of the road. This is a separate matter from the running of the furnace, and it should be considered by itself. Whether the furnace should be continued where it is, or rebuilt near Clifton Forge, or moved to the neighborhood of Mann's Creek is a question to be settled afterwards. I hope before long to give a specific statement of the quality of the ores as to sulphur and phosphorus.

JOHN M. ORDWAY.

Mass. Inst. Technology, Oc. 11th, 1876.

*Since this letter was written a standard gauge RR. has been made from the furnace, across Rich-patch Mn., to the C. & O. R'y. near Jackson's River station, and the Richmond & Alleghany RR. has been constructed up the James and through the Jackson River Gap.—ED.

The American Institute of Mining Engineers, will hold its annual meeting in Philadelphia, Feb. 15–18, 1881. The program is an attractive one, embracing receptions, social and musical; excursions to iron. steel, and platinum works; the reading and discussion of important papers, especially some in reference to steel rails, etc. The meetings will be held in the halls of the Franklin Institute and the American Philosophical Society.

Geological and Mineralogical Explorations in Virginia.—Correspondence.

STAUNTON, VA., Dec. 30, 1880.

MAJOR J. HOTCHKISS:—

Dear Sir—I received a letter by to-day's mail, from Prof. Fontaine, in which he says he will adopt my suggestion, and commence his scientific exploration, in April, at Waynesboro, and proceed thence along the line of the Shenandoah Valley RR. to some point near Balcony Falls. This fact is of great importance to the people of Augusta and Rockbridge, and I am persuaded that great results, to the state at large, will follow from his investigations, as it will probably lead to the investment of large amounts of foreign capital in iron properties. Respectfully yours,

ALEX. H. H. STUART.

THE SOUTHERN FERTILIZING COMPANY,
RICHMOND, VA., Jan'y 10, 1881.

MAJ. JED. HOTCHKISS, EDITOR "THE VIRGINIAS:"—

My Dear Sir—I was favored, some two months ago, with a visit from Mr. Edward Atkinson, of Boston, the eminent economist. He told me many things to my profit, and I described, as best I could, the progress of affairs in Virginia. In speaking to him of the opening of the James River Valley by a railway, and the mineral stores it would doubtless develop, he observed that he would endeavor to have the class of geology and mineralogy in the Massachusetts Institute of Technology (Prof. William B. Rogers, President,) spend their summer months there, in company, of course, with their professors.

Mr. Atkinson is a director in that institution, and, as a rule, succeeds in what he undertakes. It occurred to me that it would be well if the party could be joined by similar classes from some of our own schools of learning. It would not only be profitable all round, but be, perhaps, the means of laying the foundation, among the young gentlemen, of lasting and valuable friendships. Yours truly,

JOHN OTT, Secretary.

West Virginia—Points in its Favor.—Mr. W. H. Dewees, Carkin, Kanawha Co., W. Va.—who, in our columns, offers his services in exploring, developing or purchasing mineral lands, and whom we gladly commend to those needing such services—has issued the following excellent circular in regard to West Virginia, where he, a Pennsylvanian and brother to J. H. Dewees one of the geologists of that state, has located himself.—What he says in reference to West Virginia we fully endorse.

"In calling your attention to the resources of West Virginia, I desire that you should specially note the following points in its favor, viz:—(1) That it is pre-eminently the mountain and mineral state of the Union. (2) That it has within its borders immense deposits of superior Gas, Splint, Cannel and Coking Coals, in beds lying convenient for mining and adjacent to water and railroad transportation. (3) That by reason of there being large deposits of various kinds of iron ore closely associated with cheap fuel and convenient to the best markets of the country, the state is peculiarly favored as a locality in which to erect furnaces and other iron-works. (4) That by reason of its central geographical position, and other natural advantages it will eventually supply most of the coal consumed throughout the Mississippi Valley. (5) That much of the land is well adapted for grazing and sheep-raising. (6) That the price at which land is now being sold is so greatly out of proportion to its productive capacity, that the opportunities for purchasing it, at present figures, cannot long continue.—Before making investments elsewhere let me ask you to consider the inducements offered by this state for the profitable employment of capital."

A COOKING DEPARTMENT, wherein the art of how-to-cook both theoretically and practically is taught, is now in full blast at the flourishing Augusta Female Seminary, Staunton, Va. Mrs. Helen Campbell is the teacher; she is furnishing a series of papers on "Food and the Laws of Food" to the *Staunton Spectator*.

Norfolk, Va.—The Bay Line is about to contract for a new freight steamer, some 210 ft. long and of 800 to 1000 tons register, to run between Norfolk and Baltimore.

TIMBER.—A correspondent of the *Richmond Dispatch* states that there is a large quantity of original growth of cypress, oak, poplar, and pine along the Chickahominy that will be made accessible by the extension of the Chesapeake & Ohio Ohio Ry. from Richmond to Newports-News.——Withrow & Nettleton saw, near Alleghany Station of the C. & O., cut and deliver to the railway company about half-a-million feet of superior lumber each month.—*Tribune.*

HOOP-POLES, a half million in number, are wanted, by H. J. Skinner at Ronceverte, W. Va., on the C. & O. R'y.

Population—Movement in Virginia, 1860 to 1880.

BY THE EDITOR.

The Superintendent of the Tenth Census of the U. S., Hon. Francis A. Walker, having kindly favored THE VIRGINIAS with a manuscript copy, in advance of publication, of the "first count of population" of Virginia in 1880,—a count that may be slightly varied "by reason of the discovery of omissions or duplications of names in the lists of inhabitants returned,"—we are enabled to present to our readers, in this number, the population-movement in Virginia, as now constituted in area, from 1860 to 1880, as revealed by the census returns of 1860, 1870 and 1880.—The presentation is by counties, grouped topographically and by the natural grand divisions of the state, as first recognized and described in the *Geographical and Political Summary of Virginia, by Jed. Hotchkiss*, published at Richmond, Va., 1876. This grouping is also, in a general way, a geological one, as may be seen by refering to the Geological Map in the June, 1880, No. of THE VIRGINIAS.

1. "Tidewater" Grand Division.

Area, 10,850 Square Miles.

Counties. *Grouped topographically.*	*Population.* 1860.	1870.	1880.
King-George, . . .	6,571	5,742	6,397
Westmoreland, . . .	8,282	7,682	8,846
Richmond, ...	6,856	6,503	7,198
Northumberland, . .	7,531	6,863	7,929
Lancaster, ...	5,151	5,355	6,160
Essex, ...	10,469	9,927	11,032
Middlesex, ...	4,364	4,981	6,252
King-and-Queen, . .	10,328	9,709	10,502
Mathews, ...	7,091	6,200	7,501
Gloucester, ...	10,956	10,211	11,876
Caroline, ...	18,464	15,128	17,243
King-William, . . .	8,530	7,515	8,748
Hanover, ...	17,222	16,455	18,588
New-Kent, ...	5,884	4,381	5,515
James-City, ...	5,798	4,425	5,422
York, ...	4,949	7,198	7,348
Warwick, ...	1,740	1,672	2,257
Elizabeth-City, . . .	5,798	8,303	10,691
Henrico, ...	61,616	66,179	82,956
Charles-City, ...	5,609	4,975	5,512
Prince-George, . . .	8,411	7,820	8,861
Surry, ...	6,133	5,585	7,391
Sussex, ...	10,175	7,885	10,062
Southhampton, . . .	12,915	12,285	18,012
Isle-of-Wight, . . .	9,977	8,320	10,572
Nansemond, ...	13,693	11,576	15,904
Norfolk, ...	36,227	46,702	58,654
Princess-Anne, . . .	7,714	8,273	9,394
Accomac, ...	18,586	20,409	24,409
Northampton, . . .	7,832	8,046	9,152
Total, ...	344,872	346,305	420,384
Number to square mile,	31.69	31.91	38.74

2 "Midland" Grand Division.
Area, 12,470 Square Miles.

Counties. (*Grouped topographically*)	*Population.* 1860.	1870.	1880.
Alexandria,	12,652	16.755	17,545
Fairfax,	11,834	12,952	16,025
Prince-William,	8,565	7,504	9,180
Stafford,	8,555	6,420	7,210
Spotsylvania,	16,076	11,728	14,829
Louisa,	16,701	16,332	18,941
Fluvanna,	10,353	9,875	10,802
Goochland,	10,656	10,313	10,292
Buckingham,	15,212	13,371	15,540
Cumberland,	9,961	8,142	10,540
Powhatan,	8,392	7,667	7,817
Chesterfield,	19,016	18,470	23,773
Appomattox,	8,889	8,950	10,080
Prince-Edward,	11,844	12,004	14,668
Amelia,	10,741	9,878	10,3.7
Dinwiddie,	30,198	30,702	35,375
Nottaway,	8,836	9,291	11,156
Lunenburg,	11,983	10,403	11,535
Brunswick,	14,809	13,427	16,707
Greensville,	6,374	6,362	8,407
Campbell,	26,197	28,384	36,250
Charlotte,	14,471	14,513	16,653
Pittsylvania,	32,104	31,343	52,589
Halifax,	26,520	27,828	33,588
Mecklenburg,	20,096	21,318	24,611
Total,	371,035	363,932	444,490
Number to square mile,	29.75	29.18	35.63

3. "Piedmont" Grand Division.
Area, 6,680 Square Miles.

Counties. (*From Potomac southwest.*)	*Population.* 1860.	1870.	1880.
Loudoun,	21,774	20,929	23,634
Fauquier,	21,706	19,690	22,993
Culpeper,	12,063	12,227	13,408
Rappahannock,	8,850	8,261	9,291
Madison,	8,854	8,670	10,562
Greene,	5,022	4,634	5,829
Orange,	10,851	10,396	13,051
Albemarle,	26,625	27,544	32,615
Nelson,	13,015	13,898	16,535
Amherst,	13,742	14,900	18,705
Bedford,	25,068	25,327	31,205
Franklin,	20,098	18,264	25,084
Henry,	12,105	12,303	16,009
Patrick,	9,359	10,161	12,833
Total,	209,132	207,204	251,754
Number to square mile,	31.31	31.02	37.69

4. "Blue Ridge" Grand Division.
Area, 1,230 Square Miles.

Counties. (*Blue Ridge Plateau*)	*Population.* 1860.	1870.	1880.
Floyd,	8,236	9,824	13,255
Carroll,	8,012	9,147	13,323
Grayson,	8,252	9,587	13,068
Total,	24,500	28,558	39,646
Number to square mile,	19.92	23.22	32.23

5. "The Valley" Grand Division.
Area, 7,550 Square Miles.

Counties.	*Population.* 1860.	1870.	1880.
Frederick,	16,546	16,596	17,553
Clarke,	7,146	6,670	7,682
Warren,	6,442	5,716	7,399
Shenandoah,	13,896	14,936	18,204
Page,	8,109	8,462	9,965
Rockingham,	23,408	23,668	29,567
Augusta,	27,749	28,763	35,113
Rockbridge,	17,248	16,058	20,003
Botetourt,	11,516	11,329	14,809
Roanoke,	8,048	9,350	13,105
Montgomery,	10,617	12,556	16,693
Pulaski,	5,416	6,538	8,750
Wythe,	12,305	11,611	14,318
Smyth,	8,952	8,898	12,159
Washington,	16,892	16,816	25,203
Total,	194,290	197,967	250,523
Number to square mile,	25.73	26.22	33.18

6. "Apalachia" Grand Division.
Area, 4,520 Square Miles.

Counties.	*Population.* 1860.	1870.	1880.
Highland,	4,319	4,151	5,164
Bath,	3,676	3,795	4,482
Alleghany,	6,765	3,674	5,586
Craig,	3,553	2,942	3,794
Giles,	6,883	5,875	8,794
*Bland,	.....	4,000	5,004
Tazewell,	9,920	10,791	12,861
Russell,	10,280	11,103	13,906
Scott,	12,072	13,036	17,233
Lee,	11,032	13,268	15,116
Total,	68,500	72,635	91,940
Number to square mile,	15.16	16.07	20.34

*Bland was formed in 1861 from Giles, Tazewell and Wythe. Dickenson county was formed in 1880 from Russell, Wise and Buchanan, but a separate census of it was not taken.

7. "Trans-Apalachia" Grand Division.
Area, 1,200 Square Miles.

Counties.	*Population.* 1860.	1870.	1880.
Buchanan,	2,793	3,777	5,694
Wise,	4,508	4,785	7,772
Total,	7,301	8,562	13,466
Number to square mile,	6.08	7.13	11.22

8. Total Population of Virginia, by Grand Divisions.

Natural Grand Divisions.	1860.	1870.	1880.
1. Tidewater, : : :	344,872	346,305	420,384
2. Midland, : : : :	371,035	363,932	444,490
3. Piedmont, : : : :	209,132	207,204	251,754
4. Blue Ridge, : : :	24,500	28,558	39,646
5. The Valley, : : :	194,290	197,967	250,523
6. Apalachia, : : :	68,500	72,635	91,940
7. Trans-Apalachia, :	7,301	8,562	13,466
Total population of Va.,	1,219,630	1,225,163	1,512,203

8. The increase of population in Virginia, as a whole, from 1860 to 1870 was only 5,553, about 45-100ths of one per cent, a result showing, not only the great losses that a state so rich in resources must have sustained, in the four years of gigantic warfare that had its chief field of operations within its borders during that decade, but also the long and severe struggle it cost to restore its population to a mere state of stable equilibrium. As before stated, there were slight gains in Tidewater which had the *varied pursuits* of agriculture, commerce, navigation, fishing, oystering, trucking, lumbering, and manufacturing, and, on its borders, quarrying, to aid in its more speedy recuperation. Midland and Piedmont, regions hitherto largely engaged in planting—especially that bane of Virginia, tobacco—and having at that time little variety in their industries, both declined in population. The other grand divisions where a mixed husbandry, farming, grazing, etc., prevailed, and where the natural grasses had maintained the integrity and fertility of the soil, not only recovered but made considerable gains in population. They also had advantages in the homogeneity of their people.

The increase in the state between 1870 and 1880 was 287,040, one of over 23 per cent—*a most vigorous growth*, especially when the fact is considered that it is *a native one*, a product of the state, for the census of 1880 shows that there were but 884 more foreigners in Virginia at that time than there were in 1870. No other single fact can so well assert and attest the self-contained capacity of this state, not only for recuperation but also for an almost undreamed of development. The vigorous growth of the state is further evidenced by the fact that the male population gained more rapidly than the female—one of the best signs of a thriving state—for while in 1870 the females were 31,047 in excess of the males, in 1880, notwithstanding the increased population, they were but 21,109 in excess.

9. The following table recapitulates, from the preceding ones, the facts of *density of population*, in each grand division and in the state, at each of the censuses under consideration; it also tabulates the *areas* of the grand divisions and gives that of the state.

Natural Grand Divisions.	Population to a square mile.			Square miles of area.
	1860.	1870.	1880.	
1. Tidewater, : :	31.69	31.91	38.74	10,850
2. Midland, : :	29.75	29.18	35.63	12,470
3. Piedmont, : :	31.31	31.02	37.69	6,680
4. Blue Ridge, :	19.92	23.22	32.23	1,230
5. The Valley, :	25.73	26.22	33.18	7,550
6. Apalachia, : :	15.16	16.07	20.34	4,520
7. Trans-Apalachia,	6.08	7.13	11.22	1,200
In Virginia, : :	27.41	27.53	33.98	44,500

At each period considered Tidewater and Piedmont were the most densely peopled, having nealy the same, although the former would show more density if only its *land* area were the basis. From 1870 to 1880 Tidewater added, in round numbers, 7 to each square mile of its area, Midland added 6, Piedmont 6, Blue Ridge 9, The Valley 7, Apalachia 4, and Trans-Apalachia 4; the state, as a whole, added 6.

The area of Virginia **is here correctly given as 44,500 square miles; the U. S. census report of 1870 gave it incorrectly as 38,348 square miles—and on that basis made its population 31.95 to the square mile.**—The exact area of the state cannot be given, because its boundaries have not, as yet, been properly surveyed. In 1873, the writer, while engaged in the preparation of a *Geological and Political Summary* for the state, aided by the best maps in existence and by the results of the U. S. Coast and Geodetic Survey, carefully and laboriously calculated the area of Virginia, by Guyot's "tables for computing surfaces on the terrestrial ellipsoid" (*Smithsonian Miscellaneous Collections*), and made it, as stated in that book, 45,000 square miles, 2,500 of which were tidal waters. In a recent controversy with Maryland, settled by arbitration, Virginia lost about 500 square miles of tidal waters, leaving her area, as stated in this article, as about 44,500 square miles some 2,000 of which are oceanic waters.—We hope Supt. Walker will correct the figures of area in the forth coming census reports; and further, that he will adopt the spelling of names of Virginia counties that is in use and approved of in this state, that of this article for example, for in "bulletin No. 50," from his office, not less than six names are spelled as no well informed Virginian would spell them.

The advance sheet of the census gives Virginia, in 1880, males, 745,547; females 766,656; native 1,497,565; foreign, 14,638; white 880,376; colored 631,827, including 6 Chinese and 65 Indians and Half-breeds.

Notes.

1. In Tidewater—Virginia's portion of the Tertiary or marine plain of the eastern United States, about one-fourth of the area of the state, including some 2,000 square miles of water surface—there was but a slight increase of population from 1860 to 1870. The war of 1861-5, in various ways, depleted its population and the remainder of the decade barely sufficed for a recovery from that depletion, and then only for the grand division as a whole. In most of the counties there was a large decrease; the only increase was in the counties containing cities, like Norfolk and Portsmouth in Norfolk, and Richmond in Henrico, or towns like Hampton in Elizabeth City, and Yorktown in York, and in the Eastern-shore counties, Accomac and Northampton that were remote from the immediate effects of that conflict. The movement was largely one of negroes from the state and from the country to the towns. Between 1870 and 1880 there was a decided increase in the population of every county in Tidewater and a very large one in those containing the cities and prominent towns, named above, and those traversed by railroads, like Caroline, Hanover, Sussex, Southampton, Isle-of-Wight and Nansemond. The growth was large also in the counties where "trucking" and fishing are leading industries, especially the former, which may be said to have become a leading industry of Accomac, Princess-Anne, Norfolk, Nansemond and other counties that are wholly or partly on the Eastern Tidewater plain, during this period. The increase from 1860 to 1870 was only about three-tenths of one per cent; from 1870 to 1880 it was over 21 per cent,—a remarkable rebound, attesting the recuperative force of the people and the productive capacities of this important grand division of the state.

2. In Mi lland—about 3-tenths of the state, the undulating higher plain of the Atlantic slope, lying between Tidewater and the Coast-range mountains, and underlaid by metamorphic rocks, and patches of mesozoic ones—the decrease of population between 1860 and 1870 was 7,103 or about 2 per cent; in 15 counties there was a decrease, but in 10 a gain. During the war the negroes flocked into Alexandria and Fairfax, the vicinity of Washington, and they increased at the expense of Prince William, Stafford and Spotsylvania that were over-run by armies. The counties traversed by railways, like Louisa, Prince Edward, Charlotte and Halifax, either gained or lost less than others. The movement towards towns is shown in the increase of Alexandria, Fairfax, Dinwiddie, Halifax and Campbell, the counties of Alexandria, Petersburg, Danville and Lynchburg. Mecklenburg, away from railways and war movements, had a natural increase.

From 1870 to 1880 there was an increase of 80,558, over 22 per cent, every county in the grand division sharing in the increase. The most marked improvement was in Spotsylvania, Chesterfield, Prince Edward, Dinwiddie, Campbell and Pittsylvania, in which are located the thriving manufacturing towns of Fredericksburg, Manchester, Farmville, Petersburg,

Lynchburg and Danville,—the counties adjacent to these towns shared in their prosperity, as their growth evidences. The increase was about 27 per cent in Spotsylvania, 29 in Chesterfield, 22 in Prince Edward, 15 in Dinwiddie, 29 in Campbell and 20 in Halifax.

3. In Piedmont—about one-seventh of the state, the Archæan region lying between the crest of the Blue Ridge and the western border of Midland—between 1860 and 1870 there was a decrease of about 8-tenths of one per cent. Half of the 14 counties decreased. The counties from Loudoun, inclusive, to Albemarle were part of the theatre of the war, and all but Culpeper suffered loss; none of the others were much involved in the war and they all, except Franklin, had a slight increase.

Btween 1870 and 1880 there was an increase of 44,550, or over 21 per cent, in Piedmont, every county in the grand division sharing handsomely in the increase, but notably those traversed by railways. Franklin gained 6,132, over 37 per cent, partly in consequence of the opening of a railway to Rocky Mount, its court-house, and the development of its iron mines. Albemarle had an increase of 5,071, over 18 per cent, arising in part from the construction of a new railway, in which benefit Orange shared, increasing 2,655, or over 25 per cent. Nelson gained 2,637, nearly 20 per cent, and Amherst 3,805, nearly 26 per cent, results arising in part from the opening of iron mines in the counties along the James.

4. The Blue Ridge triplets—embracing about 1-18th of the state and occupying her portion of the Va.-N. C. Blue Ridge plateau, a region of greatly decomposed Archæan rocks—exhibit among themselves a remarkable uniformity and steady growth in population. From 1860 to 1870 the increase in the grand division was 4,058, over 16.5 per cent, a result, in part, of their remoteness from the operations of the war and of their homogeneous and stable population. From 1870 to 1880 the increase was 11,088, very nearly 39 per cent.

5. The Valley—about one-ninth of the state, the largely limestone belt lying between the crest of the Blue Ridge and the main ranges of the Kitatiny or Great North mountain—as a whole increased 3,677, nearly 2 per cent, from 1860 to 1870. Seven of the 15 coun ties decreased some, and 8 gained. There was but little change, even in the counties that were for four years over-run by armies, the 7 of the Shenandoah valley, Frederick to Augusta, inclusive, of the list.

From 1870 to 1880 the gain was 52,556, over 26.5 per cent, every county of the grand division sharing liberally in the increase. In most of the counties of The Valley mining and manufacturing have become important industries during this decade, and these have caused a movement of population to it at the expense of counties east of the Blue Ridge; those showing largest increase are those in which those industries are most flourishing. The construction of the Valley, of the Shenandoah Valley, and of the Richmond & Alleghany railroads has promoted an increase of population, as the larger growth of the counties they traverse attests. Warren increased over 29 per cent, Shenandoah nearly 22, Rockingham about 25, Augusta over 22, Rockbridge over 24, Botetourt over 30—a growth influenced by mining operations and railway construction in 1880, Roanoke over 40, Montgomery nearly 33, Pulaski nearly 34, Wythe over 23, Smyth over 36, and Washington over 49—a most remarkable growth of humanity, equal to that of the other crops that grow on its fat, sunward-lying lands.

6. Apalachia—the nearly 1-10th of the state disposed in parallel mountains and valleys, Silurian, Devonian and Subcarboniferous in character, lying west of the Great Valley—gained 4,135 during the 1860–1870 decade, a little over 6 per cent; a secluded and sparsely peopled region, in the main, it was not much disturbed by the war. Many men were at work constructing what is now the C. & O. Ry. in Alleghany in 1860, these scattered when the war began, hence its loss in 1870. Adding the population of Bland obtained from Giles and Tazewell to those counties they would have had an increase.

In the 1870–1880 decade this grand division increased 19,305, over 26 per cent., a most notable growth considering that this region is as yet almost exclusively pastoral in its character. Alleghany is the only county that was affected by mining and manufacturing, hence its increase of 52 per cent., a consequence of the development of its iron mines and the erection of blast furnaces,—suggesting the rapid growth this state will have whenever similar developments are made in its half-a-hundred iron-bearing counties.

7. Trans-Apalachia—Virginia's portion of the Great Carboniferous Plateau, now a remote and inaccessible region, but one that will soon become important when railways, now in process of construction, reach its rich iron- and coal-fields—had a steady growth in each decade here tabulated; from 1860 to 1870 its increase was over 17 per cent; from 1870 to 1880 its increase was over 57 per cent--the most considerable one among the grand divisions, indicating that its period of prosperity has already begun. Wise county, in which the Tinsalia Coal and Iron Co. is making developments, gained over 62 per cent.

VENNOR, the so-called weather prophet, "predicted" of January, 1881, among other things, equally reliable, "the thaw, which will be interrupted by a brief cold spell, will extend from about the 18th of this month into February," and in his February vaticinations the "into" it is said, will be "*balmy, spring-like weather*," with his usual reservations, "to the 12th." The actual weather of this period has been about the coldest and most disagreeable of the whole winter, up to this date, Feb. 3d. His whole scheme is an absurdity, when fairly tested, and as worthy of belief as the teachings of the astrologers; it is a "revolution" part of the "evolution" craze of our day.—The "indications" of our weather service are based on the atmospheric movements that are in progress over the continent; movements that by the far-reaching fingers of the telegraph are kept well in hand so that the "chief" can see, almost to a certainty, which way they are going. What is seen and known is recorded, and we have found it reliable from a regular study of it almost from the inception of the "service." All we fear is that this parading of Vennor by the newspapers, with favorable comments, because he may "hit" now and then, just as anybody could, will for a time draw attention from our national weather service, which has proved itself one of the great modern inventions, ranking in usefulness with the telegraph and railways, at a time when an effort should be made to induce Congress to give it a larger appropriation that it may establish more "stations" and so become even more efficient and useful than it now is. There are but two regular stations, Norfolk and Lynchburg, in the Virginias, where a dozen could be profitably occupied. Go to now, give Vennor and his Canadian wind-bags the go by, and let us go for our share of the United States weather.

Col. John G. Stevens, of Trenton, N. J., President of the United Railroads and Canals of N. J., a well known authority and writer upon industrial questions, visited Virginia late in 1880, in the interest of large investors in the securities of the Richmond & Alleghany R. R., "to gain exact information as to the present condition and future prospects of that road." He has favored us with a copy of his very able report from which, in a future number, we shall make copious extracts, especially from that portion devoted to the question of the manufacturing of iron on the line of that railroad.—Col. S. visited these States again during the present month, and we had the pleasure of accompanying him, for ten days, in an examination of blast furnaces and iron ore beds in the basin of the James, in Virginia, and of coal beds and coke ovens on the line of the Chesapeake & Ohio Ry., in West Va. Great benefits will enure to these states from having the character and economic conditions of their mineral resources investigated by such an acute and trained observer and so accurate a writer upon industrial questions, especially manufacturing ones, and whose conclusions will be accepted as authorative. Col. Stevens went away deeply impressed with the great extent and variety and the superior character of our iron ores and coals, the largeness of our forest resources, and the advantages of every kind here existing, including that of commercial position, for the cheap manufacture of iron.

The Shenandoah Iron Works of Hon. Wm. Milnes, Jr., Page Co., Va., has made from Jan. 1st to Dec. 11, 1880, at its furnace No. 2, from Primordial iron ore, mined near the furnace at the western base of the Western Blue Ridge, 2,200 long tons of charcoal pig iron; and at its bloomary 1,635 tons (2464 lbs to the ton) of charcoal blooms. About 250 men, including wood-choppers and colliers, are employed at these works. The iron made there ranks with the best in the market. The Shenandoah Valley R. R. is now running its trains from the Chesapeake & Ohio Ry., to and beyond these works, saving them a 24-mile haul to railway, and greatly facilitating their operations. Coke from the New River district is now used at these works, much to their profit. We hope that early in 1881 there will be commenced there the construction of furnaces, rolling mills etc., such as will bear some proportion to the magnitude and character of the great ore deposits, limestone quarries, timber and other resources of the 49 square miles of territory owned by this "Shenandoah Iron, Lumber, Mining and Manufacturing Co. of Va." in the Shenandoah Valley, crossed by and extending for many miles on each side of the Shenandoah Valley R. R.

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James River Steel, Manufacturing and Mining Co.,

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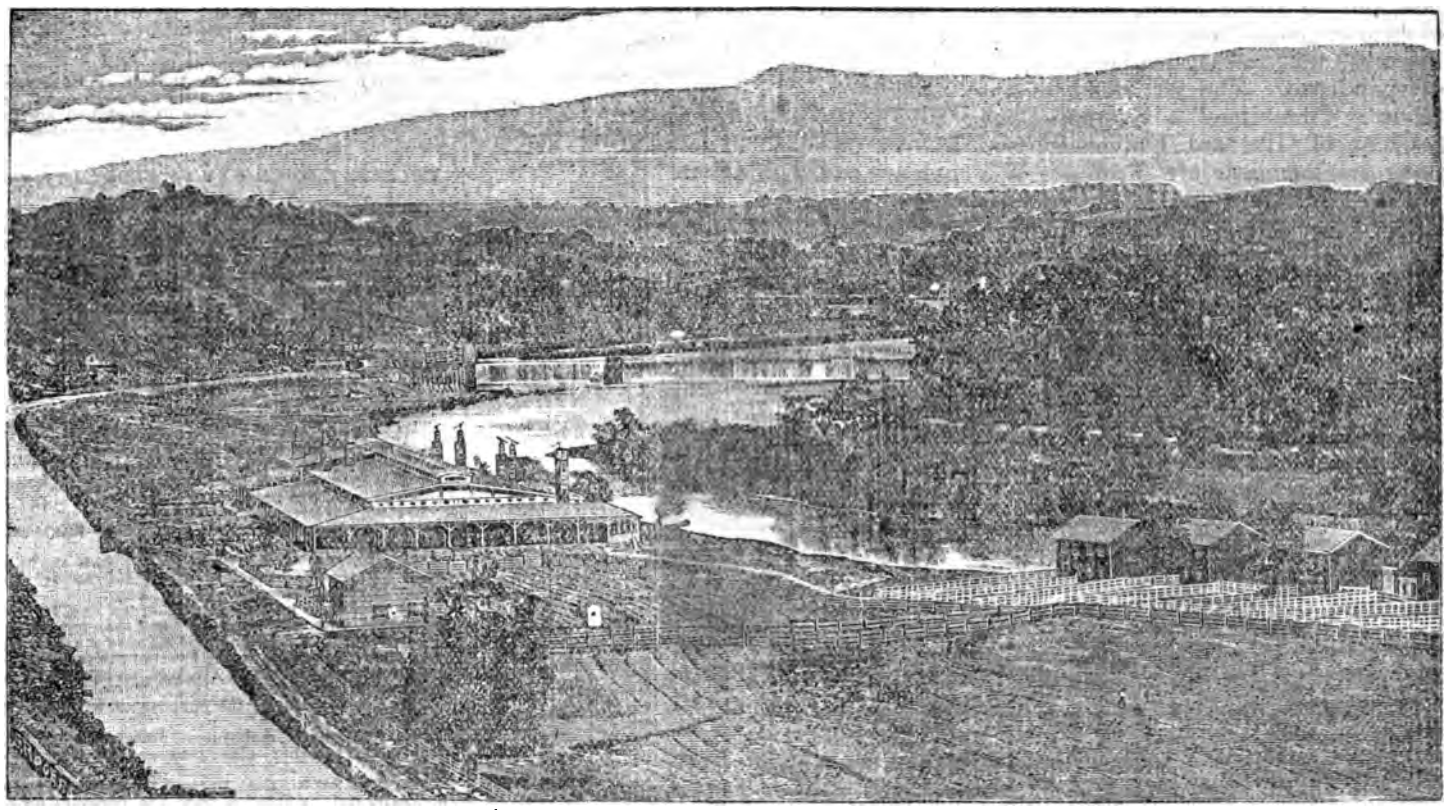

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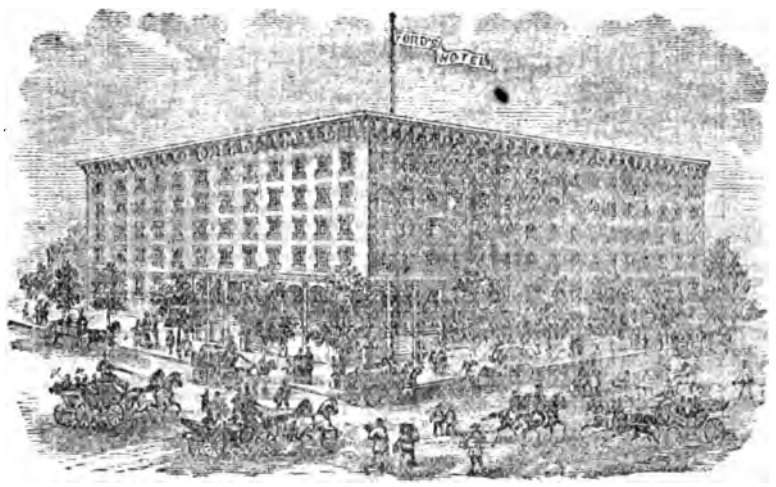

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The "Old Reliable." The People's Favorite. Complete in all its Appointments.

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THE VIRGINIAN is an independent Republican newspaper, devoted principally to the interests of the Great Valley, and Mineral Regions adjacent thereto. Its circulation is larger than that of any other weekly newspaper published in Virginia. As an advertising medium, especially for farming, grazing, and mineral lands, &c., it has no superior. Parties desiring to buy or sell real estate will find it to their advantage to make use of its columns. Specimen copies free.

THE "STAUNTON SPECTATOR,"
129 E. Main Street,
Staunton, Virginia.

The "SPECTATOR" is published every Tuesday morning, at Staunton, Augusta county, Virginia, and is the best advertising medium in the interior of the State.

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Staunton, Virginia.

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It is the unparalleled and unapproachable for the wildness, sublimity and picturesque beauty of scenery, and the healing virtues of its health-giving fountains. It is the **Short Line Between the Seaboard and the Great West,** and is second to none in construction, equipment and appliances for the safety and comfort of its passengers.

Through Tickets to all Western towns and cities, and excursion tickets to the watering places and summer resorts, are for sale via this line at all principal ticket offices everywhere.

J. C. DAME, Southern Agent, Richmond, Va.; H. W. CARR, G. E. Agent, 229 Broadway, New York: CONWAY R. HOWARD, G. P. & T. A., Richmond, Va.

Young Men's Society for Home Study is the name of an association that has just been organized to induce young men over fifteen to take up systematic courses of study, research, and reading at home, and to afford them, by guidance and encouragement, opportunities for so doing; the instruction to be given by correspondence. The chairman of the "Advisory Committee" is Samuel Eliot, President of Harvard University, and among its members are Professor William B. Rogers, formerly of the University of Virginia and Virginia's geologist, and President Arthur Gilman, of the Johns Hopkins University of Baltimore.

Red oak is coming into use, says the *Northwestern Lumberman*, and it and birch and gum must soon take the place of walnut, white oak and cherry to a great extent. Some large orders for red oak are out at this time.

WESLEYAN FEMALE INSTITUTE,

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One of the first Schools for Young Ladies in the Union. Climate unsurpassed. Buildings elegant, Surroundings beautiful. With twenty teachers and officers. Attended present session (1880–81) by 120 pupils, representing seventeen States.

Terms moderate. For catalogue, address

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Coal and Coke Dealers.

FIRE CREEK COAL AND COKE COMPANY,
Fire Creek, Fayette Co., West Virginia,
MINERS OF
Red Ash Bituminous Steam Coal,
and manufacturers of **Hard Coke.** All correspondence should be directed to
M. ERSKINE MILLER,
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W. A. BURKE,
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Sole Agent for Nu'allburg Coal & Coke;
The best steam coal on th market; coke superior to Connellsville.
Shipper of Kanawha Splint and Gas Coals.
Points of Shipment:—R chmond, Va., and Huntington, West Virginia.

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Collections in Virginia and West Virginia promptly attended to and remitted on day of payment, at lowest rates of exchange
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NATIONAL VALLEY BANK
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Wholesale and Retail Dealer in
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Wholesale and Retail Dealer in
Hardware, Cutlery, &c.,
Augusta St., opp. Court-house,
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WIRE TRAMWAYS.
The most economical system for the transportation of ores, coal, lumber and agricultural products,—especially adapted for carrying coals from the New River and Kanawha Coal-fields in place of Inclines, or across the Rivers to the Railway, in place of Bridges. They avoid gradings, cuttings or embankments, are not affected by floods or s now. Inclines of 1 in 3 are admissable They can be used to transmit power as well as material.
Send for estimates and other information to
THE AMERICAN WIRE ROPE TRAMWAY CO.,
328 Walnut Street, Philadelphia, Pa.

Blasting Powder.

LAFLIN & RAND POWDER CO.
ARISTA HOGE, Agent,
Staunton, Virginia.
Orders for Powder or Fuse promptly attended to Address FRANK ALEXANDER & CO., or ARISTA HOGE.

VIRGINIA WATER-POWER AT DANVILLE.
Persons wishing to purchase the splendid Water-power at Danville, Va., can do so on
VERY REASONABLE TERMS.
This is a fine opening for Rolling Mills, Paper Mills, Foundries, &c., &c. Apply in person or by letter to me as the attorney for the owners.
F. E. BOULDIN,
Danville, Va.

Real Estates, Water Power, &c.

COMMISSIONERS' SALE
OF THE
STAUNTON IRON WORKS,
STAUNTON, VA.

In pursuance of a decree of the Circuit Court of Augusta County, rendered on the 30th day of November, 1876, in the cause of "Menifee's adm'r vs. McMahon" therein pending, the undersigned special commissioners will proceed, on the premises in Staunton, Va., on

THURSDAY, the 24th DAY OF FEBRUARY, 1881,

to sell at public auction to the highest bidder, the real estate, machinery, patterns, flasks and stock on hand, &c., belonging to the Staunton Iron Works Co.

The real estate, a lot 130 ft.x160 ft., is situated on the corner of Lewis and Frederick streets, 4 blocks from the depot of C. & O. R'y Co., and has on it a 2-story machine and wood shop, 30x60 ft., 2-story office and pattern shop, 12x20 ft., foundry building 40x60 ft. with core oven 12x20 ft. in rear, storing building 20x40 ft., ample sheds, blacksmith shop, stable, &c., &c.

The machine shop is fitted up as follows:
One 16-horse power engine,
One 60-inch pulley lathe,
One 30-inch lathe, 18 feet between centers,
One 22-inch lathe, 8 feet between centers,
One 12-inch lathe, 5 feet between centers,
One planer that will plane 24 in.x24 in.x7 ft. long,
One 14-inch drill press,
One No. 2 Merriman's bolt cutter,
One No. 2 shaper, which will plane 9½x18 in.,
&c., &c., &c.

The pattern shop contains about $2,000.00 worth of good patterns for Player's Hot Blast Stove, Saw Mills, Engines, Plows, Stoves, &c., &c.

The works are in full running order and in full operation, with more work on hand than can be executed. Lying as they do in the midst of the thriving City of Staunton, and in the heart of the rapidly developing iron district of Virginia, no better investment could be offered.

This sale is made for the purpose of winding up two estates.

The real estate, machinery, patterns, tools, &c., will be sold together—other personal property separately.

TERMS OF SALE:—Cash in hand to pay costs of suit and sale, and the balance, as to the personal property, on a credit of six months, and as to the realty, on credits of one, two, and three years, with interest, the purchaser to execute bonds with approved personal security for the deferred payments, and the title to be retained as ultimate security.

H. W. SHEFFEY,
H. M. BELL,
jan6-tds Commissioners.

FOR SALE.
A Farm Four Miles North of Charlottesville,
Containing **214 acres,** with buildings, good timber and running water thereon. Several veins of iron ore and heavy veins of quartz, highly mineralized with pyrites of iron, and galena and zinc sulphurets. Supposed to contain gold, silver and copper. Examination of the same and correspondence invited. Address G. J. BARNHART,
Charlottesville, Va.

SALE OF VALUABLE PROPERTY.
Dr. H. S. Eichelberger offers for sale his handsome residence and beautiful farm at Verona, on Valley RR. The farm contains about 120 or 130 acres, and lies on the west side of the Valley pike. The Doctor is willing, if only a small quantity of land is desired, to sell with the residence 15 or 20 acres, which will embrace all the improvements, the finest young bearing orchard in that section, with a spring not excelled for the coldness of the water in the State, with fine dairy attached. This is a rare chance to secure a quiet, lovely home within a ten minutes ride of the city of Staunton, by rail. Its location adapts it well for a summer resort: it is also a good point for a physician. He would invite any one who wishes a quiet, lovely home, free from the noise of city life, to this handsome property. For terms, apply to H. S. EICHELBERGER, Verona, Augusta county, Virginia, or to ELDER & NELSON, Staunton, Virginia.
The Doctor will take pleasure in showing the property.

RESIDENCE IN STAUNTON FOR SALE.
I offer for sale the Residence of Mrs. Virginia B. Donaghe, fronting on three of the principal streets—Main, Lewis and Frederick—in immediate proximity to business, churches, schools, &c. The improvements are first-class, and the property one of the best, if not the very best in the city, either as a home or a speculative investment. It will be subdivided if not sold as a whole. Examination invited.
Terms:—Ten per cent cash, and balance at one, two, and three years, with semi-annual interest.
THOMAS D. RANSON.

THE OLD BLACKFORD FORGE PROPERTY,
Including Water-power and Over 600 Acres of Land,
On Hawksbill Creek, Below Luray, Page County, Virginia,
And on line of Shenandoah Valley Railroad, is hereby offered for sale. For terms, etc., address
Box 281, Staunton, Va.

The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 2. } Staunton, Virginia, February, 1881. { Price 25 Cents.

The Virginias,

PUBLISHED MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor,

At 346 E. Main St., Staunton, Va.

Terms, including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising, per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors.), complete, with index and title page, will be sent, by express or mail, prepaid, to any address in the U. S., *on receipt of Three Dollars.*

Attention is invited to new advertisements.—(1) To sale of *Staunton Iron Works*, to be made Saturday, April 2nd, 1881.——(2) To the card of *Prof. J. J. Stevenson* offering his professional services. The thorough character of his work is shown in the admirable illustrated paper on the geology of parts of Lee, Wise, Scott and Washington counties, S-W. Va., the first of which appears in this number. Dr. Stevenson is well known and recognized as one of the leading active geologists of America.——(3) To the *granite quarries*, near Petersburg, Va., which Dr. D. W. Lassiter offers for lease. We have visited these quarries and examined the granite from them that has been for many years exposed in buildings, and know of no better. We advise any one desiring to embark in this business where all the conditions for success, including access to markets in all directions,—especially to east and west by the Norfolk & Western Ry.—are among the very best, to correspond with the advertiser.——(4) To the *blast-furnace* and to the *iron ore, manganese* and *timber lands* offered for sale by D. S. Pierce, Esq. These lands are in the great Primordial iron and manganese range of the Western Blue Ridge, one of the richest mineral belts in the United States. The furnace is one of the group in S-W. Va. reported on for 1880 in this number. These properties are well worth the attention of iron-masters seeking for places where superior iron can be cheaply made.——(5) To the sale of the "*Doctor Peters*" *iron lands* in Nelson county, Va., on the 13th day of May, 1881. These lands are, undoubtedly, among the best ore-bearing ones in the now noted James River valley, of which we have published so much in the THE VIRGINIAS. We will have more to say about this iron property hereafter.——(6) To the advertisement of *Roanoke College*, one of the most flourishing institutions of learning in the State of Viginia; located in one of the most charming portions of the Great Valley, where the climate is all-the-year-round salubrious, and where the surrounding influences are among the very best. Young and vigorous, this college has proven itself an important educational agent. It offers especial inducements to those of limited means.

Amherst Furnace, of Buena Vista estate, Amherst Co., Va., was in blast 20 weeks, in 1880, and made 1,035 tons of charcoal pig iron. Charcoal to a ton of iron averaged 140 bushels, including that used to heat the furnace at the start; the charcoal was made in the vicinity of the furnace. Ore used, from Buena Vista banks, Rockbridge Co., Va., from the Primordial, was 2 tons to the ton of iron. The flux used was ½ ton of tufaceous marl to the ton of iron, also from Rockbridge Co., from deposits made by waters percolating Valley limestones. The Messrs. Jordan say, "the marl answers our purposes admirably, and is cheaper than limestone." Col. Hardin, of the Va. Mil. Inst., analysed this marl and reported that it contained nothing to injure the quality of the iron; it contained a mere trace of phosphorus.—The unusual winter froze the canal by which ores were brought, so this furnace was compelled to bank up for a time, but it is now in blast again. It has charcoal now housed for some 275 tons of iron.

Newports-news.—Property is changing hands at a large increase at this to be eastern and deep-water terminus of the C. & O. Ry. Lands that a month ago were held at $10 to $12 per acre are now held at $50 or $60. A town has been laid out and a large force is now at work on the wharves of the C. & O.

The Tinsalia Coal & Iron Company, through the untiring energy of its manager, Gen. John D. Imboden, has secured the passage of a bill by the legislature of N. C. by which it becomes the purchaser of the Cape Fear & Yadkin Valley RR. by means of which it will be able to have, by July, 1883, a completed line of railway from its great body of superior coal and iron lands at Imboden (See map and paper of Dr. Stevenson elsewhere in this number), by way of Estillville and Mendota to Bristol, where it crosses the Norfolk & Western Ry. (A. M. & O.)—to which it will become a most important feeder, and thence to the Atlantic. From Bristol its route will be to Elizabethton, Carter county, Tenn.; thence up Watauga river to Boone, Watauga county, N. C., on the Blue Ridge plateau, the great copper and iron region; thence through Cook gap of the eastern side of the plateau, in the vicinity of Grandfather mountain, to Patterson, Caldwell county, in the valley of the Yadkin; thence to Greensboro, on the head waters of the Cape Fear river, where it meets a great railway centre; and thence down the valley of Cape Fear river, by way of Fayetteville, to Wilmington, and Smithville, harbors near the mouth of Cape Fear river, on the Atlantic at 34 degrees N. latitude.

At Patterson this line will meet the Chester & Lenoir narrow-gauge railway and its connections through S. C. to Georgetown and Charleston, giving a choice, by unbroken gauge, of four important southern seaports.

The Chatteroi RR., which runs up the Big Sandy (Chatterawha) from the C. & O. at Catlettsburg, and is now in operation to Louisa and in process of construction to Piketon, Ky., proposes to extend its line to Pound gap and thence to Imboden,—thus making a through line of narrow-gauge railways, from the Ohio to the Atlantic, through a great region that abounds in more mineral, forestal and agricultural wealth than almost any other region in the world.

We have not now space to dwell upon the vast resources at the command of this company, and upon the grand results, in the way of development, that will follow, to the Virginias and to the Carolinas, upon the completion of its proposed railways; but we shall resume the subject in our March number.

Lee, Wise, Scott and Washington counties, Va., are brought before the public in a most attractive way, both scientific and economic, by the very able memoir of Prof. Stevenson, of the University of the City of New York, about half of which, with its sections and colored geological map, which—through his courtesy and that of Dr. J. P. Lesley, Secretary of the American Philosophical Society, for which we thank them,—we are enabled to give to the public in advance of its appearance in the Transactions of that Society. The remainder of the memoir, giving geological descriptions of the areas of the map drained by Powell, by Clinch, and by Holston rivers, will be given in our next issue.

No apology is needed for occupying so much space with this memoir, for it furnishes reliable information on a scientific basis—the only one that can be relied on, for the development of the mineral wealth of some 700 square miles of Virginia territory, presented in such a way that any one having observing intelligence can understand and apply it. It furnishes a field-book for the study of the geology of the region mapped, and we commend it as such to the young men of that section and advise them to study it. The Tinsalia Company is entitled to a vote of thanks for so generously giving to the public what has cost it so much, and so also is Dr. Stevenson.

It is very gratifying to note the hearty recognition made by Prof. Stevenson of the excellence of the work done in the same region by Prof. Wm. B. Rogers more than 40 years ago, as shown on his geological map of the Virginias which was published in this journal in June, 1880.—We regret that Dr. Stevenson did not use Prof. Rogers' recent clear and simple sub-divisions of the Carboniferous, and his Virginia system of numbers for formations, at least parenthetically, more than he did. They are the key to correlation, and, we may say, to rapid apprehension, here. We consider the use of the term "Pottsville conglomerate" very objectionable, and also that of "Quinnimont group," as we will show hereafter.

At Quinnimont Furnace, of the Pa. & Va. Iron & Coal Co., Fayette Co., W. Va., in 1880, there were mined 45,953 tons of Lower Measures coal; made 26,819 tons of coke and 9,350 tons of iron. The average number of men employed was about 180. Of the coal mined 41,456 tons were used in the coke ovens at the coal mines near the furnace, yielding an average of 64.7 per cent of coke; 1,843 tons of coal were shipped by the C. & O. Ry., and 2,644 were used at the works.

Iron-Making in James River Valley, Virginia.

By John G. Stevens, of New Jersey.

Note.—As intimated in our Jan., 1881, issue, we give, below, extracts from the "Report on the Richmond & Alleghany RR.," made in Dec., 1880, by Col. John G. Stevens, of Trenton, N. J., the well known president of the United Railways and Canal of N. J., in reference to the advantages existing in the valley of the James, along and near the line of the R. & A. RR., for the manufacture of iron, and the cost of iron-making there at this time. Col. Stevens writes after a thorough personal investigation, and his statements, so highly favorable to this region, may be accepted as conclusive.—We know that his conclusions have been strengthened by a visit made to this section since the writing of this report.—Ed.

Regarding this great valley of the James from a railroad stand-point, the great extent of its resources at once arrests the attention of even an indifferent observer. The river pierces through mountains containing iron ore, limestone, slate, granite, and marble. The presence of these immense mineral deposits, the contiguity of the iron ores and limestone to the coal measures, the light grades descending with the bulk of the trade, the natural fertility of the soil, the abundance of water-power, are conditions so favorable that they may well be called exceptional.

I propose now to consider the extent and character of the resources and capabilities of this valley, with particular reference to their influence on the traffic of the Richmond and Alleghany Railroad. The most important of all interests is undoubtedly that of iron; and this will be first considered. This subject is so large and interesting that it is well worthy of a very extended treatment; but the proper limits of a paper of this kind will only admit a brief reference to the more salient points of practical interest.

The iron ore formation begins at a point about one hundred miles above Richmond, and extends almost continuously to Williamson. It may be divided into two sections. The one having its centre at Riverville, thirty miles below Lynchburg. This belt extends about thirty miles along the road. The great body of the other district lies between the mouth of the North river (extending up that stream) and Williamson. Limestone is found in close proximity to the ores. One of the best and purest deposits as yet opened is near Indian Rock, about thirteen miles from Buchanan. It is said to contain ninety-five per cent of pure lime. The coke ovens available for this road are situate on the line of the Chesapeake and Ohio Railway; the average point of shipment will be about one hundred and fifteen miles west of Williamson.

The lower district abounds in magnetic, specular, and brown hematite ore. The analyses made by Professor Campbell of Virginia, Professor Cook of New Jersey, and other scientific experts, show a percentage of sulphur and phosphorus so small as to make these ores suitable for the manufacture of Bessemer steel, provided it should be found practicable to mine them without admixture with others less pure. Should this prove to be the case, a very large market would be at once opened for them, both in the east, at Pittsburg, and other points on the Ohio, which are now dependent for their higher grade ores on Missouri and Lake Superior. Transportation from points so remote necessarily makes their cost very high: the quotations at Pittsburg of Lake Superior ores are now about ten to twelve dollars per ton.

But while the analyses referred to have undoubtedly been very satisfactory, experience is yet wanting to prove that these ores can be smelted and produce an iron suitable for Bessemer steel. The conditions under which analyses are made in a laboratory differ so essentially from those which govern practical smelting, that while the results are extremely valuable in indicating probable qualities of iron, yet it has been found in practice that they cannot be implicitly relied upon. In view of the want of definite information on this point, perhaps it would be advisable for the railroad company to send suitable quantities of these ores to furnaces, and subject them to the test of being actually smelted; of course selecting from several localities. It is most important to the railroad that their true value be known. But whether those from the lower district are suitable for Bessemer purposes or not, it is conceded that they are capable of producing iron of the higher grades. The Powhatan furnace, near Richmond, used largely of these ores with great success, the iron made proving to be of very superior quality.

The ores of the upper district are mainly brown hematites and limonites. These do not show as small a percentage of phosphorus, but make superior grades of foundry iron. It is believed that a mixture of ores from the two regions will be found advantageous, and that both will also be used in the furnaces on the line of the Chesapeake and Ohio road, and at Ironton, Pittsburg, and other points on the Ohio river. Contracts have been already made for delivery of ores from the upper section to furnaces beyond the line of the Richmond and Alleghany Railroad. The ores from both sections are rich, and will average about forty-five per cent of product.

As a rule, the veins of the lower district are from three to five feet thick; in the upper section they are larger. With a proper expenditure for working, the ore can be laid on the ground at a cost varying from seventy-five cents to a dollar and a half per ton. The expense of mining in the lower section will probably exceed that of the upper.

The average distance from the quarries to the railroad will be about a mile and a half. The cost of transport will, of course, vary with the facilities furnished. At points where large amounts are mined, side roads or suspended wire rope will be adopted.

Coke can be made, with a fair profit, at about one dollar and seventy-five cents per ton. As the demand has exceeded the supply, the price is now temporarily higher. The larger furnaces will probably mine their own coal and make their coke. In such cases, the price will be lower than that named. The main part of the cost of coke and limestone will be the railroad freight, and consequently the cost of making iron will depend largely upon the action of the railroads. It is so evidently the interest of the Richmond and Alleghany Railroad Company to stimulate the development of the iron industries, that it cannot be questioned that they will establish low rates; a contrary policy would have, at this time, a paralyzing effect.

Assuming that the rates are reasonable, that sufficient capital is invested in the opening of mines, and the construction of tramways, and that the plant generally is fitted for the purpose, I have estimated the cost of making one ton of iron at Riverville, at Lynchburg, and at a point twenty miles below Williamson, to be as follows, based on existing wages and fair rates of freight:

1. At Riverville	$13.31
2. At Lynchburg	13.46
3. Below Williamson	11.35
The average being	$12.70

It is probable that the product of the lower section will command, in the market, about one dollar per ton more than No. 3; in which case the net profit would be about one dollar less. The percentage of ores that experience will prove to be desirable for mixture may modify slightly these relative results. The tendency will be for the product of the lower section to seek the Eastern market, and that of the upper the Western.

Believing that the future traffic of the road would be largely dependent upon the cost of production of iron, I have taken great pains to arrive at reliable results. The details of cost have been gone over very carefully with experts—practical miners and others—from whom reliable facts could be obtained; and I feel entirely confident that the cost will not exceed that stated above, with fair average conditions. The general weight of opinion would, I think, favor a lower estimate of cost. From the best information that I can obtain, I would place the cost of making iron on the Lehigh, Schuylkill, and at Pittsburg at $19, $19.50, and $21.50 per ton, in the order named, being an average of $20, and $7.50 more than the estimate of cost on the James.

This large difference in the cost of production between Pennsylvania and Virginia will, of course, turn the attention of the iron masters of the former state to the latter; and it is very possible that a large part of the increased production needed annually will be supplied hereafter from points in the vicinity of James river.

The Low Moor furnace, lately started near Clifton Forge, has been a great success. I was informed by a gentleman holding an interest there that the daily product is ninety-five tons, and that the managers are already looking for ores on the line of the Richmond and Alleghany Railroad. A furnace has just been erected by Philadelphia parties at Lynchburg, and is now about to go into blast. The results of its operations are awaited with great interest. There can be no reason to doubt but that it will prove a success, in which case there is every probability that the construction of several more furnaces will be started at an early day at Lynchburg or in its immediate neighborhood, and completed by the time the railroad is constructed.

The history of the iron trade in this country shows that its

production brings in its train other iron manufactures: rolling mills, machine shops, nail works, follow necessarily; and in that view, the possession of an extensive water-power, which can be utilized at different points, is very important. This power, while valuable in itself, is still more so incidentally, as it will furnish at a cheap rate all that is required for manufacturing purposes. At Richmond alone, it has been estimated, as has been stated above, to be equal to 44,000 horse-power at the lowest stage of water. At Lynchburg, also, the power is large. When the extent of the fall of the James from Buchanan to Richmond, and that of the North river from Lexington to its mouth, are considered in connection with the volume of water on these streams, some idea can be formed of the extent of the power that now runs to waste.

The natural fertility of the valley, and the warm climate, making the cost of living less than at the North, thereby cheapening labor.

In some of its general conditions, the James valley is not unlike that of the Schuylkill. Both have a fertile soil, and are near the coal measures. The latter has the advantage of being nearer to the Eastern market, and the former to the Western, where prices of iron generally rule higher. The striking advantages of the James lie in the greater cheapness of its ores, fuel, and wages, and in its reliable water-power, thus surrounding the production of iron and its attendant manufactures with the most favorable conditions.

It cannot be doubted by any intelligent person who has examined the subject but that this valley will, in the course of a few years, be the seat of a great iron manufacturing industry, and be filled with thriving towns, and an industrious population. And it is pertinent here to call attention to the fact that railroad traffic from a district of this character is much greater per head of population than from a strictly agricultural community. As noted above, ores will be shipped to furnaces beyond the line of the road; but only approximate estimates can be made, at this time, of the probable amount. It is, however, quite certain that an immediate demand will arise, which is of consequence to the company, as it will furnish traffic at once.

In reference to the new business that will come to this road from the operation of furnaces.—As was stated above, one has already been constructed at Lynchburg, but I have not learned that the construction of any others has actually been determined upon. It is probable, however, that within the next year a number will be commenced. The demand for iron consequent upon the outlook of general business is undoubtedly in good; and preparations are now in progress to erect furnaces in localities not as favorable as the James valley. It could probably be safely estimated that within a year furnaces capable of producing 150 tons a day will be located upon the line of the Richmond & Alleghany RR. The amount of freight furnished will depend very much on the location. I estimate that it will average $2.50 per ton of iron made. This would make the yearly production of iron 56,575 tons, and the receipts therefor $141,437.50

The amount of ore shipments is likewise dependent upon conditions that are not yet determined. Mines are being opened at various points, and there can be little doubt but that a supply can be furnished to meet a large demand, which will undoubtedly arise, provided the qualities of the ore should equal expectations. The furnace managers on the Ohio river are looking to the James valley for a large part of their ore supply, particularly that of the higher grades. I estimate the amount shipped to points outside the line of road at 75,000 tons, and the freight received therefor at $55,000.

It would be incorrect to say that the iron industry of the James valley is yet in its infancy; it has not yet been born. It soon will be, and its growth and development will assure to the road a great future. Nor will the process be a slow one, nor dependent on local causes. The business of making iron will simply overflow from Pennsylvania to locations further south, and, as the furnaces of that state will still remain in operation, no existing interests will be materially changed or disturbed. Pennsylvania capital and skill will seek the James, inasmuch as it presents the best locations to supply the additional iron requirements of the country, and this will promote a development of a rapid character. Without doubt this can be further hastened by a recognition of the fact that a virtual partnership will exist between the road and the capital that thus seeks investment on its line, and by the establishing of such a broad policy of management as will attract this capital.

La Agricultura y los Montes de los Estados Unidos. Por D. Jose Jordana y Morera, Jefe de primero clase del cuerpo de Ingenieros de Montes. Publicada de orden del Ministerio de Fomento, Madrid, 1880.

The work of which the above is the title, forms an octavo volume of 378 pages, and represents one of the most extended and carefully written reports by foreign commissioners to the International Exhibition at Philadelphia of 1876. Señor Jordana y Morera was the member of the Spanish Commission charged with the investigation of the agriculture and forests of the United States, and this report upon the information he collected has recently been published by order of his government.

It has come to be generally recognized that within the last twenty years Italy has made immense progress in material and intellectual activity, and is today very far from remaining the slumbering nation, or aggregate of petty nationalities, which she was so long considered to be. It is probably not so widely known that new industrial life has sprung up in Spain, and that not in literature alone, but in science both pure and applied, Spanish names are making themselves honorably known in other lands, and that the Spanish government distinguishes itself by the enlightened energy with which the resources of the great peninsula and of its magnificent colonies are examined and compared with those of other countries with a view to practical development.

The work before us is a proof and an illustration of this. It consists of four parts. First, a brief and general description of the geography, meteorology, geology and geognosy of the United States. Second, an extended account of all that concerns the agriculture of this country, including the area of land in and out of cultivation, legislation as to agriculture and the settlement of government lands, organization of the Bureau of Agriculture at Washington, agricultural schools, colleges and societies, agricultural tools and machinery, fertilizers natural and manufactured, the various crops of grain, tobacco, cotton, sugar, grapes, potatoes, hay, &c., the different domestic animals, and such animal products as wool, silk and honey. Third, a very interesting and full account of all matters relating to forests and forest management; the area and distribution of forest covered land, the specific character of forest vegetation, the causes of the destruction and waste of American forests, and the efforts so far made by government and by private organizations to remedy the evil, legislation on the subject, artificial plantations and forest culture, tools used in felling trees, stump extractors, saw-mills, shingles, charcoal, tanner's and dyer's barks, sumac, turpentine collection and distillation, maple sugar making, paper pulp from wood, &c. Fourth, a brief consideration of advances and improvements in agricultural and forestal industry which the author considers may with advantage be imported from the United States into Spain, to the benefit of the material interests of the latter country. Under this head the points which are suggested as of most importance are, an improved Census after the pattern of that of the United States, and the general introduction into Spain and her colonies of American agricultural machinery.

Per contra, two useful lessons may be learned here by reading this report. The one, that the intelligent and minute attention bestowed upon the survey, by a foreigner, of American resources of the field and forest may well be imitated by those to whom these resources belong, and upon whom rests the responsibility of wisely improving them. Particularly is this true in regard to the originally magnificent, but sadly wasted, forests of the country; in this direction there is much to be gained by Virginians, as well as by the people of other States, from attention to the judicious views and to a large extent intelligent practice of forest culture in Spain. The other lesson, that in the very insufficient notice in this report of Virginia tobacco, Virginia grape culture, and other resources of this state, may be seen an evidence of the unfortunate neglect with which such communities are inevitably treated as fail to avail themselves of proper opportunities for displaying before the world the products they have to contribute to the world's wealth. Such a lost opportunity for this State was the Philadelphia Exhibition of 1876.

University of Va., Feb. 22, 1881. J. W. Mallet.

Chesapeake and Ohio Railway Lumber Agency, of which Mr. William L. Rawson is the capable and efficient General Agent, with his office in Richmond, Va., has issued the following circular, which we publish as a matter of general interest:

"This agency was established in 1879, for the purpose of aiding in the development of the timber and lumber resources contiguous to the C. & O. R'y in Virginia and West Virginia; and also as a medium for reliable transactions between buyers of lumber for foreign or domestic use, and the lumber manutacturers on the line of the road. It is also designed to encourage and assist the demand for, and the distribution of lumber for local consumption; and, by all legitimate and practicable means to increase the business, and to so reduce the expenses of selling, handling and delivery as to render it more advantageous to all parties concerned.

"Buyers of lumber in large lots have the assurance that all orders entrusted to the agency will have the prompt and constant attention of our lumber agents, and that the lumber will be inspected at point of manufacture, before forwarding, by duly qualified inspectors.

"The advantages to mills are as follows: There is no expense whatever to them in seeking a market for their lumber. They need manufacture nothing but what is salable. They avoid all the risk and uncertainty as to payment, which would be incurred in shipments to markets to be sold upon delivery, as well as fluctuating rates of freight, loss by fire or marine disaster, charges for wharfage, insurance, inspection, handling, interest on advances, and other minor items, besides the almost certainty of having some of their lumber reported short in measurement, or rejected as culls, worth but half price, and sometimes nothing.

"All lumber purchased by the agency is measured and inspected at place of loading, and paid for when on cars. Lumber unsuited for orders of the agency can often be sawed over or cut off into other sizes or qualities suited for railway use, which is also inspected and measured when loaded on cars, and taken on usual terms of purchase by the company. The timber is thereby worked up to the fullest extent possible.

"Taking all these facts into consideration, the benefit to the mills on or near the line of the C. & O. R'y in disposing of their lumber through the agency, is equivalent to from $3.00 to $5.00 per thousand feet in the price of their lumber.

"Manufacturers are invited to correspond with the General Agent and report their facilities for furnishing lumber, stating explicitly the kinds and quantities they may with certainty be relied on to furnish; and also to send to him from time to time, statements fully describing any lumber they may have on hand for sale, for which the agency will endeavor to find a market."

The lumbering interests of these states will benefited by observing the following excellent "general remarks," and by having a knowledge of the "standard of inspection," which we give below, both from the the C. & O. R'y Lumber Agency. One reason why Virginia lumber fails to command the best prices in the markets is that it is badly prepared and will not bear inspection.

eneral Remarks in Regard to the Manufacture of Lumber; which it is especially desired to impress upon the manufacturers, and by which it is important that they should be guided in order that their lumber may be in the best marketable condition and bring full value, and also as having an important bearing on the *grading* of their lumber; and which inspectors are specially instructed to take into full consideration as part of the rules for their inspection. Both inspectors and manufacturers should note carefully these remarks as to lengths, edges, thickness, width, and condition, in reporting lots of lumber on the line of the railway for sale.

Lengths should be 12, 14 and 16 feet (any other lengths should be made only to order). Sixteen feet lengths are preferable, and will generally command higher prices. *All lumber* should be made not less than one inch nor more then two inches *longer* than the measured length. *Ends* must be square. Logs should be sawed off and not chopped. *Edges* must be square, and free from rotten or stained sap.

Thickness and Width.—All lumber manufactured for stock, or to order, must be sawed true, and should be sawed one-eigth inch over the measured thickness and width, except inch boards, which are required to be plump inch *when dry.* There is more inch lumber sold than any other thickness; but thicker lumber generally brings a higher price than inch, and wide lumber a higher price than narrow.

All Lumber, of whatever kind, should be *handled with care*, and as soon as sawed, well stuck up, clear of the ground. Stickers or cross pieces, about three inches wide, should be placed between each course, one sticker to cover each end of the course so as to prevent checking. If the lumber is 16 feet long four stickers should be used; if of shorter length, three will answer. They must be placed directly over each other in every course to the top. Boards in each course should have not less than two inches space between to allow of free circulation of air and hasten drying, and, when the pile is completed, it should be closely roofed over to keep off sun and rain.

Standard of Inspection for Lumber.—The following specifications have been adopted for the inspection of the various kinds and grades of lumber manufactured on the C. & O. R'y; and they will govern all transactions in buying and selling on the the part of the Lumber Agency, except where otherwise specially agreed upon. In arriving at a standard for the inspection of lumber, the endeavor has been to meet the requirements of buyers in the various markets in which lumber from this section is sold, as well as to establish an equitable classification for the producer. The grades will be called and known as Firsts (or No. 1), Seconds (or No. 2), Culls (or No. 3).

Yellow Poplar (white-wood).—*Firsts or No.* 1.—Ten inches and upward wide, free from knots, sap, shakes, heart-cracks or other defects. Boards, say 14 inches and up, admit of some fresh sap, according to width. Plank three inches and four inches thick will allow of a few pieces eight inches wide in a lot, if perfect.

Seconds, or No. 2.—Eight inches and up wide, white sap allowed on one side; if ten inches and up, two or three small sound knots, according to width, will be allowed; no shakes or heart-cracks. Plank three inches and four inches will allow of six-inch widths, or, if perfect, a few four inches to six inches wide in a lot.

Culls, or No. 3.—Any width or quality that will not pass above inspection, in which is included irregularly sawed lumber, discolored sap, some shakes and checks, or lumber that cannot be used without waste, but does *not* include worthless stuff.

Special specifications will be given for poplar flitches, chair and settee plank, and piano, coffin and coach-panel stock, and for extra wide boards cr plank, when ordered.

Black Walnut.—*Firsts.*—Not less than eight inches wide, free from sap, knots, shakes, heart-cracks or splits; wide pieces will admit of *slight* defects that would not be taken in narrow widths.

Seconds.—Not less than six inches wide; a little sap and a few small, sound knots allowed, according to width. No shakes or heart-cracks. If perfect a few pieces in a lot may be admitted as narrow as four and five inches. No lumber in this grade should cut to waste.

Culls.—Any width, more or less sap, and five to seven knots, according to width; will allow of lumber that cuts to waste in working up; also irregularly sawed lumber; but no *worthless* stuff is included.

In walnut of three and four inches thickness there is no stipulation as to the widths; it will be allowed in the grading as above, if 3x4 or 4x4, a few pieces in a lot; but stock smaller than 3x4 or 4x4 should be sawed into baluster or chair stock. In some instances eight feet lengths are taken on above classifications. Special specifications will be given for walnut flitches, newels, chair, baluster, counter-top and coffin stock, and for extra wide beards or plank, when ordered.

Ash.—*Firsts, Seconds and Culls.*—Inspection will be the same as for poplar, excepting that fresh, sound sap is allowed, the same as if heart, and, owing to the nature of the timber, with due allowance for splits from seasoning. Must be free from heart-cracks or dry-rot, in firsts and seconds grades.

Cherry and Butternut (white walnut).—Inspection same as for walnut.

Bass-wood.—Inspection same as for poplar or white-wood.

Maple, Beech, Sycamore, Hickory and Chestnut — Special specifications in accordance with the different uses to which these woods are adapted.

White Oak.—*Car Lumber.*—Must be of good quality of fresh cut timber, free from large or unsound knots, splits, shakes, worm holes or decay; square edges and ends; sawn true to size, hearts only allowed in the square stuff, and then must be near the centre.

Merchantable, or Tie Grade.—Anything in plank or other size timber, free from rot and wind shakes, but admitting of more knots, light splits, and other slight imperfections than would be allowed in car stuff, and in which the main requirement is: that it be free from any defects that will impair its strength and durability.

The above is the *general* inspection, and in the main will meet the requirements for the grades in oak now in most active demand. Specifications differ with almost every bill for this kind of timber, and much is dependent upon the judgment of the inspector, having particular regard to the uses for which it is intended; but particular specifications, accompanying bills, and on which contracts are based, must be strictly followed.

White Pine.—No suitable classification can be given herein that would meet an inspection which varies in every market of the Union. Of white pine there are hundreds of millions of feet of excellent quality, contiguous to and accessible from the line of the C. & O. R'y. The business of manufacture, though steadily increasing, is as yet in comparative infancy, compared to the field opened for large and successful working.

Logs.—The main requirements for shipping logs of any kind of timber are: That they be straight, ends sawed off square, of good color, thin fresh sap, straight grained and to all outward appearances sound. Logs that are somewhat defective are sometimes taken, with due allowance therefor. Specifications vary as to diameters and lengths required, as also whether with bark on or off, round or hewn, and whether measured inside sap or mean diameter at small end, and whether, by Scribner's rule, solid contents or cubic.

WILLIAM L. RAWSON,
Richmond, Va., March 1, 1881. General Agent.

James River Steel M. & M. Co., Lynchburg, Va., is now turning out daily 45 tons of 16 and 18-lb. T rails, and fish-plates, bolts, nuts, spikes, &c., for use with same. We are gratified to learn, from Supt. T. C. Jones, that this establishment is now filling orders for rails and "fastenings" from the Richmond & Alleghany RR., and from mines and furnaces on the Chesapeake & Ohio Ry.; for "fastenings" from the Va. Midland and the Norfolk & Western (A. M. & O.) railways, and for bar iron (of which it makes the usual sizes, up to 2¼ inch "flats" and "rounds"), to the trade generally. We advise all our readers having use for such articles as this Co. makes to buy from it for their own advantage as well as for the upbuilding of such an enterprise in Central Virginia.

Murphy Run Coal Mine, near Clarksburg, Harrison county, W. Va., is in the "9-ft. seam" which yields about 8½ ft. of coal; the mine has been worked since 1866; it works about 60 men and produces from 15,000 to 20,000 tons a year of rich, bituminous gas coal that makes a 17.5 candle power gas. This coal contains fixed carbon 49.080, volatile combustible matter 37.105, sulphur 2.840, ash 9.400 and moisture 1.575. It is marketed in New York, Washington, &c. It belongs to the Burr Wakeman estate.

Rossett Iron Mine, at Irontown, Taylor county, W. Va., is owned by F. L. Clare and operated by C. S. Hurd. The mine is worked by drift and furnishes "hard" and "shell" ore from the same stratum. It gives employment to over 60 men and furnishes to Waldorf Furnace some 12,000 tons of ore a year, but is not worked to more than half its capacity.

West Fairmont & Marion Consolidated Coal Co. owns and operates a gas coal mine at Fairmont, Marion county, W. Va., working 7½ ft. of the "9-ft. vein." Some 26 men are worked and from 50,000 to 75,000 tons of coal are mined annually, and marketed chiefly in Baltimore and New York. Mr. Davidson is the agent.

Sewell colliery, of the Longdale Iron Co., Sewell station, John A. McGuffin manager, produced, in 1880, not far from 13,000 tons of coal, which was all converted into coke for use at the Lucy-Selina furnace of the company in Alleghany Co., Va., 130 miles, by rail, from the colliery. This Co. has 100 coke ovens now in operation and is constructing 20 more that it may supply both of its furnaces, it having recently put in blast a second and new one, at Lucy-Selina, as stated elsewhere. The yield of coke at Sewell in 1879 was 65⅝ per cent of the coal used. This Co. has been mining the "Sewell" seam, the bottom one of the Middle Measures, but it has recently been opening one of the Lower Measure beds, probably the "Fire creek," which it will mine before long.

Gaston coal mine, near Fairmont, Marion county, W. Va., is owned by James Boyce, James O. Watson and A. B. Fleming, who, as partners, operate it as Gaston Gas Coal Co. The coal mined is bituminous gas, from the "9-ft. bed," 8 ft. of which is taken. About 50 men are employed and about 20,000 tons are mined yearly and marketed east to Washington and Baltimore, and west to Chicago, St. Louis, etc. The mine is over a mile, by a branch, from the B. & O. RR.

Palatine coal mine, near Palatine, Marion county, W. Va., is owned and operated by the Newburg Orrel Coal Co. Coal mined is bituminous gas, from the "9-ft. vein," 7 ft. of which is here worked in two headings with about 1,000 ft. of working face. From 20,000 to 25,000 tons of coal are mined yearly, by some 30 employés, and marketed to the B. & O. RR. and points on its line, and to Baltimore. Mr. Morgan D. Orr is the superintendent.

Montauk Gas Coal Co. has its mines at Flemington, Taylor county, W. Va., on the Baltimore & Ohio RR. The mine, opened in 1878, is on what is called the "9-ft. vein" which is here some 75 ft. below the general surface of the country, and furnishes about 8 ft. of available coal. About 200 men are here employed and over 60,000 tons of coal are sent yearly to market, mostly to New York where the company has its principal office.

Despard coal mine, Clarksburg, Harrison county, W. Va., is owned and operated by the Despard Coal Co. The 9-ft. bed of gas coal is worked, by drift, under a cover of some 75 ft. This company employs about 60 men and now mines about 40,000 tons of coal yearly, which is marketed in Baltimore and at points along the B. & O. RR.; some is sold to the B. & O. Co., to whose railroad a branch leads from the mine.

Tyrconnel coal mine, at Tyrconnel, Taylor county, W. Va., is owned and operated by the Newburg Orrel Coal Co. The bed mined is the "Pittsburg vein" which there furnishes 8-ft. of gas coal. This mine, which was opened in 1872, now works about 50 men and mines some 30,000 tons of coal a year, which is marketed in Baltimore and at places on the B. & O. RR.

Central Gas Coal mine, Fairmont, Marion county, W. Va., is owned and operated by Oliver Jackson. About 8 ft. of bituminous gas coal are taken from the "9-ft. vein," Some 20 men are employed and about 6,000 tons are marketed yearly, to Chicago, to Tiffin and Newark in Ohio, and to points on the B. & O. RR.

Farland Gas Coal mine, Clarksburg, Harrison county, W. Va., belonging to D. J. Adams, is now leased by J. T. Farland. The mine is in the 9-ft. seam. Some 40 men are employed at this mine, which has a present output of about 12,000 tons a year, the coal going to Chicago and other western markets.

Buffalo Gap Furnace, of the N. Y. & Va. Iron & Coal Co.,—on the C. & O. Ry., Buffalo Gap, Augusta county, Va., as we learn from Capt. D. P. McCorkle, the general superintendent, was in blast 78 days, in 1880, running with a light burthen, and made 650 tons of pig iron.—This furnace was put in blast in March, 1880, and ran but one week when it was burned. By an accident to its hot blast oven it was forced to go out of blast late in 1880; but repairs are nearly completed and it will soon go into blast again.

A Geological Reconnaissance of Parts of Lee, Wise, Scott and Washington Counties, Virginia.

By John J. Stevenson, Professor of Geology in the University of the City of New York. (With six wood cuts and a colored map.)

Read before the American Philosophical Society, January 21, 1881.

Introduction.—In a former memoir,* the writer described a small part of Lee and Wise counties, and gave some casual observations respecting a part of Scott county. Examination of a larger area has shown that two serious errors, due to too ready acceptance of information respecting localities not visited, occur in that memoir, and has led also to a change in opinion respecting the structure of Stone mountain.

The counties examined occupy the extreme southwest corner of Virginia; Lee being in the angle between Kentucky and Tennessee, with Wise adjoining it along the Kentucky line, while Scott and Washington lie next along the Tennessee border.

The surface is broken by rudely parallel mountain ranges, separated by narrow valleys. The distance along the shortest line from the city of Bristol to the Kentucky border is barely fifty miles, yet in following that line one must cross Walker, Brushy and Clinch mountains; Moccasin, Copper and Buckner ridges, Powell mountain, Wallen and Poor Valley ridges, Stone and Black mountains. Several of these ridges are single, and have abrupt slopes, while others are compound, and their slopes afford grades not too difficult for wagons.

The area between the Great Valley of Virginia and Moccasin ridge is drained by the Holston river; that between Moccasin ridge and Powell mountain, by Clinch river; and that beyond Powell mountain to the Kentucky line, by Powell river. The Clinch and Holston unite to form the Tennessee river, and Powell river enters the former at not far from Knoxville. Of these rivers, the Powell rises within the area examined; the others have their sources far beyond toward the northeast.

A narrow strip of this region along the Kentucky border has been examined by Mr. P. N. Moore, of the Kentucky Geological Survey, and a summary account of his observations is given in the reports of that Survey, Vol. IV. Prof. Lesley's work as described in his memoir,† is slightly overlapped by the writer's examination. The whole region was examined during the survey under Prof. W. B. Rogers. One is compelled to regret that the reports of that survey are so rare; since the map prepared by Prof. Rogers and published in "The Summary of Virginia," shows that the structure was admirably worked out. The faults are clearly shown on that map, and the distinction between the limestones of the Lower Carboniferous and Lower Silurian was determined accurately, though at that time there was little aside from physical characters to depend on for identification. When it is remembered that the region was even more thinly settled forty years ago than it is now, one may not refrain from acknowledging the skill and patience with which the structure was worked out at that early day.

To obtain the material given in this memoir, one section was followed from Black mountain almost directly to Bristol; a second from Pennington gap in Stone mountain to the Tennessee line by way of Estillville and Moccasin gap through Clinch mountain; shorter sections were followed across Moccasin and Copper ridges; while several of the faults were followed for from ten to twenty miles. Necessarily, many interesting details were neglected, and some points of importance were left undecided, as the object of the reconnaissance was purely economic.

No map worthy of the name exists, and that accompanying this memoir is based on the old state map, made in 1825. Some gross topographical errors have been corrected partially; others remain, which interfere seriously with a proper presentation of the geology; but to correct these would involve a complete reconstruction of the whole.

1. General Structure of the Area.—The structure is monoclinal, and the prevailing dip is toward the southeast. The one exception is in the area between Black mountain and the summit of Powell mountain, where, as will be shown, a cracked anticlinal exists. In passing from Black mountain to the Valley of Virginia at Bristol, one crosses

1. *The fault of Poor Valley ridge.*
2. *The Wallen Valley fault.*
3. *The Pattonsville fault.*
4. *The Hunter Valley fault, or Clinch River uplift of Lesley.*
5. *The fault of Copper creek.*
6. *The fault of the North Fork of Holston.*
7. *The fault of Walker mountain.*

Black mountain is a rude mass, which owes its origin solely to erosion. It is the dividing ridge between the waters of the Cumberland and those of Powell and Clinch rivers. Its course is irregular but bears westward and southward until, at a little way west from Pennington gap in Stone mountain, it unites with the latter ridge. The only rocks exposed in this mountain are those of the Coal Measures, and their dip is northward, or north northwest. Toward Stone mountain, the dip suddenly increases until in that ridge it becomes almost, and at some places, wholly vertical.

Stone mountain is a bold narrow ridge with a N. 67° E. course, which begins not far beyond the Little Stone gap and continues thence into Tennessee. It was examined from Little Stone gap to nearly three miles beyond Pennington gap, a distance of nearly thirty miles, in which it has but two water gaps, those of Powell river and its North Fork, or, as they are commonly known, Big Stone and Pennington gaps. A wind gap, the Little Stone, affords passage for the turnpike leading from Jonesville to Gladesville.

In his former memoir, the writer regarded Stone mountain as a fault, but he is now convinced from the conditions observed at Pennington gap, that the mountain is but the side of an exceedingly abrupt fold, as will be explained in another paragraph.

In the Poor valley, which follows the southerly foot of Stone mountain, the Devonian shales are shown underlying the Lower Carboniferous. At the head of the valley, the Lower Carboniferous is well shown in the divide between the South Fork of Powell river and the waters of Stony creek, where it is in direct contact with the Lower Carboniferous of Stone mountain. In the divide, it dips gently toward the southeast, while in Stone mountain the dip is almost vertical, the incline being toward the northwest or north northwest. The dips in the mountain become sharper toward the west, being 70 degrees in Big Stone gap, and 90 degrees in Pennington gap. The rocks shown in the mountain gaps are the Lower Carboniferous, the Quinnimont group and the lower beds of the Coal Measures.

The fault of Poor Valley ridge must be described before the structure of Stone mountain can be fully explained. This fault is very nearly parallel to Stone mountain, though the increasing strength of the thrust, by turning the rocks directly on edge, has diminished the interval materially in the vicinity of Pennington gap. The distance between the two ridges varies from a mile to a mile and a half. At its eastern extremity, the fault begins in a gentle anticlinal nearly opposite Little Stone gap. A crack develops in this anticlinal near the gap, by which the South Fork of Powell river crosses it, and increases rapidly in importance westward. The Devonian shales cross the anticlinal at its origin, while in the divide at the head of the valley, the Lower Carboniferous and part also of the Quinnimont group pass over it so as to be continuous with the rocks of Stone mountain. But the anticlinal soon becomes bold, and the fault develops, so that the ridge is divided below the mouth of South Fork of Powell into Poor Valley ridge and Wallen ridge. There the extent of the fault is shown, for the Clinton is in direct contact with the middle shales of the Knox group. Poor Valley ridge continues westward to beyond the Tennessee line, and varies much in height and width. It is composed chiefly of Clinton rocks, while the Lower Helderberg, Oriskany and Hamilton occur in the narrow valley between it and Stone mountain.

The writer has stated in another paper that Stone mountain is a fault, and that it is the continuation of the *Clinch River uplift* described by Prof. Lesley. Mr. Moore, in the report of his reconnaissance along the border of Kentucky and Virginia, maintains that Stone mountain is not a fault, but that it is a

*Read before this Society, August 20, 1880.
†Proceedings of this Society, 1872.

sharp fold and a typical example of the Cumberland Mountain structure. The exposures beyond Little Stone gap and at Pennington gap show this to be true. It is precisely like the structure of Brush mountain, Kentucky, of which an illustration is given in a long cross-section accompanying another of Mr. Moore's reports. At Pennington gap the succession of Upper Silurian, Devonian and Lower Carboniferous is clear, and all the groups are conformable. Figures 1, 2 and 3 exhibit the structure of the whole fold; No. 1 being a cross-section from the northerly slope of Stone mountain to Powell mountain; No. 2, a similar section through Big Stone gap, and No. 3, the section from Pennington gap to Wallen ridge.

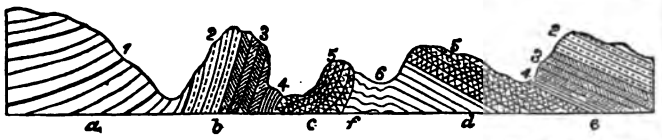


FIG. 1.—Section from Stone mountain at Little Stone gap to Powell mountain. *a*, Slope of Black mountain; *b*, Stone mountain; *c*, Powell mountain; 1, Coal Measures; 2, Quinnimont group; 3, Lower Carboniferous; 4, Devonian; 5, Upper Silurian; 6, Lower Silurian.

FIG. 2.—Section from Stone mountain at Big Stone gap to Powell mountain. *a*, Slope of Black mountain; *b*, Stone mountain; *c*, Poor Valley ridge; *d*, Wallen ridge; *e*, Powell mountain; *f*, fault of Poor Valley ridge. Numbers as in preceding figure.

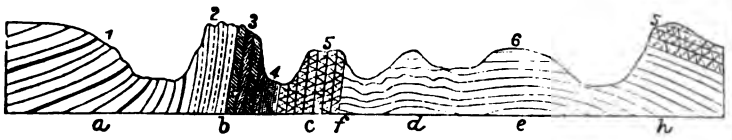


FIG. 3.—Section from Stone mountain at Pennington gap to Wallen ridge. *a*, Slope of Black mountain; *b*, Stone mountain; *c*, Poor Valley ridge; *d*, Chestnut ridge; *e*, Elk Knob; *h*, Wallen ridge; *f*, fault of Poor Valley ridge. Numbers as in preceding figures.

The change of structure beyond the fault of Poor Valley ridge will be explained in its own place.

Wallen Ridge includes the eastern extremity of Poor Valley ridge and the two ridges become separate only beyond the mouth of South Fork of Powell river. Lower Silurian rocks are shown on its northerly side, Medina sandstone forms the crest, while Lower Helderberg and Oriskany are shown on the southerly slope. The structure, where the ridge first separates itself from Poor Valley ridge, is shown in Fig. 2, which represents the cross-section from Poor Valley Ridge fault across Turkey Cove, and the mountain to Powell mountain. There the ridge is narrow; but at some miles further west the conditions are as in Fig. 3, which shows the section from the Poor Valley fault on North Fork of Powell to the Wallen Valley fault near Stickleyville, Here instead of the single ridge seen at the Turkey Cove there are three ridges, known as Chestnut ridge, Elk knob and Wallen ridge. The folds in Chestnut ridge are exceedingly complex, and are well shown in the gap by which the North Fork of Powell river passes through it. The beds are folded without crushing, though some of the angles are as sharp and close as the bent elbow. But in Elk knob the strata are practically horizontal until near the southerly slope where the dip becomes nearly 15 degrees The rate increases toward Wallen ridge as well as in the ridge, until, along the summit line, the Medina dips at nearly 40 degrees. The Upper Silurian rocks are reached on the southerly slope of the ridge.

The relations of Wallen ridge to Powell mountain are somewhat complicated by the Wallen Valley fault, which begins at the head of Wallen valley. As far as could be ascertained, no traces of that fault exist further east. That part of Powell mountain which lies east from Slemp gap, through which the North Fork of Clinch flows, has a very different structure from that of the part lying west from that gap. The eastern division is but a continuation of Wallen ridge, the separation being due solely to erosion; for, on the bold bluff which Powell mountain presents to the valleys of the South Fork of Powell river and the North Fork of Clinch river, the section is but a continuation of that shown on the slope of Wallen ridge; and the Lower Helderberg, Oriskany, Hamilton, Lower Carboniferous and Quinnimont (No. XII) group appear in regular succession, while the Quinnimont group covers the southerly slope of the mountain to where it is cut off by the Hunter Valley fault. The conditions observed on this side of Powell mountain will be described in connection with that fault.

The Wallen Valley fault begins at the head of that valley, and continues into Tennessee. It passes along the southerly side of Wallen ridge, and is crossed by the Jonesville and Estillville road at, say, nearly half a mile from Wallen creek. On its northerly side are the Lower Helderberg rocks, ill-exposed where examined, dipping almost southeast at 45 degrees, while the limestones of Formation III are shown on the southerly side dipping in the same direction at 30 degrees. The upper part of No. II is shown near the fault, but only a small part of that group is brought up where the examinations were made. It is not wholly certain that this fault begins within Wallen valley, but no traces of it were seen on the other side of the mountain, where, however, the forest is dense, and exposures are few and not satisfactory. It is certainly absent from the valley of North Fork of Clinch at three miles further up. This fault is important economically, for, in great measure owing to its sudden development, Powell mountain west from Slemp gap has been so far elevated that the Devonian, Lower Carboniferous and Quinnimont (No. XII) group, still present on the other division of the mountain, have been wholly removed by erosion.

Powell mountain west from Slemp gap is but a repetition of Wallen ridge as shown on the opposite side of Wallen valley. The limestones and shales of Formation III are exposed on its northerly side, Medina sandstone follows its crest, while the Lower Helderberg, Oriskany and a fragment of the Hamilton are shown on its southerly side. These rocks are suddenly cut off by the

Pattonsville fault, which is marked by a low ridge at, say, two-thirds of a mile from the crest of Powell mountain. No evidence of its presence was found beyond the railroad line, and, in all probability, it originates very near that line. The structure between the Wallen Valley fault and the Hunter Valley fault (Clinch uplift) is shown in Fig. 4. This fault

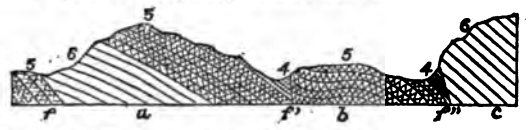


FIG. 4.—Cross-section through Powell mountain from the Wallen Valley fault to the Hunter Valley fault in Buckner ridge. *a*, Powell mountain; *b*, Pattonsville ridge; *c*, Buckner ridge; *f*, Wallen Valley fault; *f'*, Pattonsville fault; *f''*, Hunter Valley fault or Clinch uplift. Numbers as in Fig. I.

brings up the Lower Helderberg rocks against the Hamilton shales; the former describe a shallow synclinal and low anticlinal, so that, before reaching the North Fork of Clinch river, the Hamilton shales are again exposed, dipping very sharply toward the southeast. The details of this fault cannot be expressed on the map, owing to the narrowness of the area affected by it. It is evidently parallel with the Wallen Valley fault, and it is responsible for the absence of the Lower Carboniferous rocks from the valley at the southerly foot of Powell mountain. This fault, according to Prof. Safford's map, does not exist in Tennessee.

The Hunter Valley fault is the same with the *Clinch River uplift*, which is so fully described by Prof. Lesley in his memoir on the geology of Wise and Tazewell counties.* As it lies a considerable distance from Clinch river within the area under consideration, it is best to apply to it a local name. Its direction, as laid down on the map, does some violence to the truth, but the writer has preferred to give the direction of the fault properly, even though in so doing it is thrown somewhat out of its geographical relation. This fault enters Scott county near its northwestern corner, whence it follows an almost straight line to the gap made through it by the North Fork of Clinch river, being crossed very near the head of Powder Mill gap by the Bristol railroad, and by the Jonesville and Estillville road at barely two miles from Pattonsville. It is crossed but once by the North Fork of Clinch.

This is probably the most violent of the faults observed

*Proceedings of this Society, 1872.

within the region examined. The rocks on both sides of the fracture are bent upward, and, at more than one locality, the structure is distinctly that of a cracked anticlinal. The energy of the lift varied, for a long and very considerable distance, the Hamilton shales are the lowest beds exposed on the northerly side of the fault, while at several localities lower groups, even down to the Medina, have been brought up.

At the gap of North Fork of Clinch, the Hamilton shales are well exposed on the northerly side at some distance from the line of break, where they are abnormally thick, show a strike N. 80° E. mag., and are dipping toward the fault at 40 degrees. Some sandstones seen between these and the foot of Buckner ridge may represent the Lower Helderberg, and the Clinton rocks are exposed at the foot of the ridge. Whether or not the succession is complete, was not determined, as the side of the ridge is deeply covered with debris; but fragments of quartzite-like white sandstone were seen, which bear much resemblance to the Medina sandstone as shown in Moccasin gap of Clinch mountain. The exposures are all poor and the Clinton was recognized only by its fossil ore. The probable structure is doubtless as represented in Fig. 5.

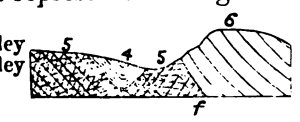


FIG. 5.—Probable structure of Hunter Valley fault at North Fork gap. *f*, Hunter Valley fault. Numbers as in Fig. I.

The fault is crossed by the Jonesville and Estillville road at two or three miles further east. There the Hamilton shales, shown in the river "bottom," appear to be in contact with the calcareous sandstones of the Knox group, which form a bold wall along the line of fault. These shales are dipping toward the fault, but they may be folded as they are near the North Fork gap. At four or five miles further east, one has passed beyond the influence of the Pattonsville and Wallen Valley faults, and has reached the southerly foot of Powell mountain in Hunter valley. Standing here at the railroad line, he can follow with his eye, the course of the fault in each direction, for it is marked by the low and sharply serrate ridge known as Buckner ridge. This seems to follow an almost straight line from the county line to the North Fork gap.

In the Hunter valley, the wall of Knox sandstone is as well marked as it is along the North Fork of Clinch, while on the other side the Quinnimont group covers the slope of Powell mountain and extends into the valley. Near the end of the valley, the North Gap structure is repeated, but only the Lower Carboniferous and the Devonian are turned up. Beyond this, no exposures exhibiting the structure were seen until Stony creek was approached. The sandstone wall is distinct all the way, but the debris from the conglomerates covers the whole "bottom" deeply even to the foot of the wall. Toward Stony creek, the structure becomes very similar to that observed in the North Fork gap, but time did not admit of working out its details. The Lower Carboniferous, the Devonian and the Silurian as far down as the Clinton at least, were recognized on Stony creek between the last exposure of the Quinnimont (Formation XII) series and the wall of Knox sandstone. The general structure, then, must be as represented in Fig. 6, which shows also the structure of Powell

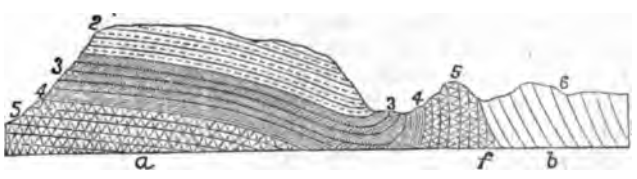


FIG. 6.—Cross-section along Stony creek through Powell mountain and Buckner ridge. *a*, Powell mountain; *b*, Buckner ridge. Numbers as in Fig. I.

mountain. The Quinnimont series caps the bluff overlooking the valley of South Fork of Powell river. Thence for several miles the dip is gentle, but within somewhat more than a mile of the fault it suddenly increases, becoming somewhat more than 30 degrees, and at the last exposure of the rock it is nearly 45 degrees. This change in rate is so abrupt that where the narrow valley follows the line of change, a fracture at once suggests itself as the only explanation of the condition.

It is altogether probable that a close, sharp fold exists within two or three miles southeast from the Hunter Valley fault. The shales alongside of Clinch river above the mouth of Stony creek are violently twisted and the plications are as close as those frequently seen in Archæan schists. The shales themselves in many places are jointed and have an indistinct slaty cleavage; but they show no other signs of metamorphism. The rock forming the bluff on the opposite side of the river is a pyritous sandy limestone very like that which is at the base of the Knox group. A similar condition was observed in crossing Buckner ridge along the Jonesville and Estillville road, at probably fourteen miles west from Stony creek.

Copper ridge lies on the southerly side of Clinch river, until within 12 miles of the Tennessee line, where it is crossed by that river. It is a monoclinal, but the dip is irregular, as is shown along the Stony creek road as well as along the road leading from Gray ford on Clinch river to Nickelsville on the southerly slope of Copper ridge. The dip at Clinch river is not far from 40 degrees; at two miles from the river, the beds are almost horizontal; but toward the southerly side of the ridge, the dip increases to almost 33 dgrees. The only rocks exposed in this ridge belong to the Lower Silurian groups. Prof. Lesley, on the map accompanying his memoir on Wise and Tazewell counties, colors Clinton along the southerly side of this ridge; but no Clinton is present within Scott county.* The structure of the ridge in this county suggests the possibility that, at no great distance eastward, the ridge may consist of a double anticlinal with a shallow synclinal along the crest, in which some Upper Silurian rocks may be held.

The Copper Creek fault, as appears from Prof. Lesley's map, extends for a considerable distance into Russell county, which adjoins Scott on the northeast. It was examined by the writer very near the Russell county line; also where the Estillville and Stony creek road crosses Copper creek; and in the Clinch River gap. This fault continues into Tennessee; it brings up the base of the upper division of the Knox group against the higher beds of the Trenton and Nashville groups. *Moccasin ridge*, lying between Copper and Moccasin creeks, and owing its existence to the Copper Creek fault, is a monoclinal with a dip throughout of little more than 30 degrees. It consists of rocks belonging to the Lower Silurian. Moccasin valley, eroded by the creek of the same name, separates Moccasin ridge from Clinch mountain, in which one finds a continuation of the series. The upper shales of No. III are shown on the northerly side, while the Medina sandstone forms the crest. Southerly dips continue beyond the crest of Clinch mountain, across the Poor valley and to the southerly side of Brushy mountain, where one reaches the

Fault of the North Fork of Holston.—Along the line of the Bristol railroad, this fault is reached at about three miles from the river, the distance being measured along the shortest line, but it is somewhat more than six miles by the railroad. Near the Tennessee line, it is little more than one mile from the river at the mouth of Moccasin creek. It extends for a long distance toward the northeast and reaches into Tennessee. This fault is not inferior to the Hunter Valley fault, for it brings up the middle division of the Knox group against the very top of the Lower Carboniferous. But it shows none of the complex structure seen along the Hunter Valley fault. Wherever examined, the Lower Carboniferous rocks dip toward the fault and are not turned up near the line of fracture. There is, however, some crumpling at a little way from the break. A synclinal was seen on the North Fork of Holston at but a little way above the mouth of Moccasin creek, and an anticlinal is described at a little way further southeast. The same condition was seen along the railroad line beyond North Fork of Holston. Abrupt changes of dip occur in the Lower Carboniferous rocks along several lines in Brushy mountain.

The Walker mountain fault follows the northerly side of that mountain and brings up the base of the Knox group so as to be in contact with the top of the Trenton and Nashville groups. This fault extends for at least eight miles. No study of structure was made between Walker mountain and Bristol, where the line of section ended. In all probability, however, a small fault occurs in that interval, for the cherty beds at the top of the Knox group occur in the immediate vicinity of Bristol.

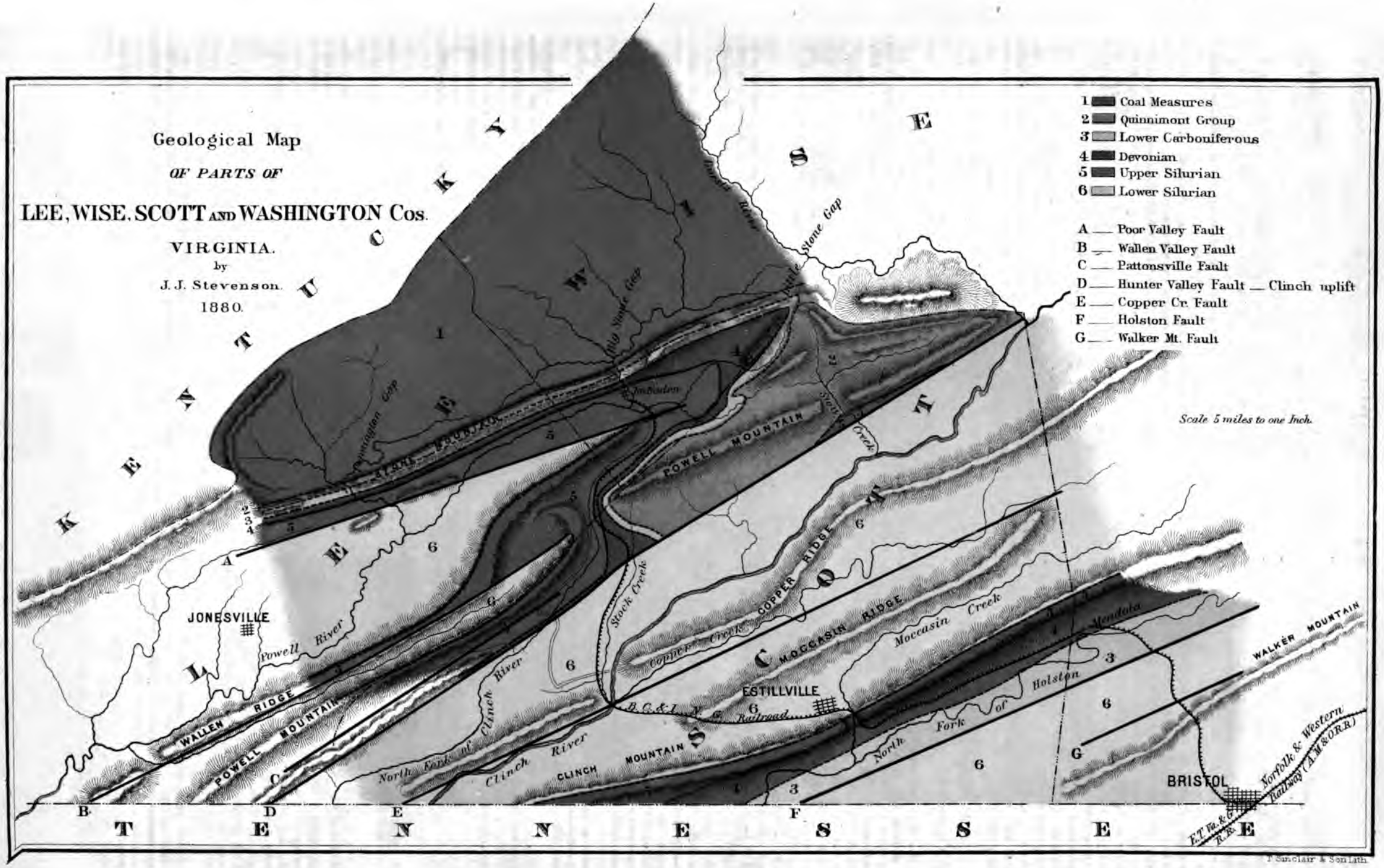
The extent of the several faults is approximately as follows:

1. *Fault of Poor valley*	2400	*feet.*
2. *Wallen Valley fault*	2800	"
3. *Pattonsville fault*	500	"
4. *Hunter Valley fault* or *Clinch River uplift*	8000	"
5. *Copper Creek fault*	30 0	"
6. *Holston fault*	7500	"
7. *Fault of Walker mountain*	3000	"

The Holston and Hunter valley faults were much greater originally, for the Coal Measures, without doubt, covered Powell mountain at one time, and it is equally probable that both the Quinnimont series and the Coal Measures existed at one time on Brushy mountain. It is altogether probable that on some of the high knobs of Brushy mountain, the Quinnimont beds have been spared from erosion. In such case, the extent of the Clinch River uplift would be not far from 10,500 feet and that of the Holston uplift very nearly 11,000 feet.

Poor Valley ridge is crossed by the South Fork of Powell river, by Powell river itself and by the North Fork; Wallen creek crosses

*Prof. Lesley did not visit this portion of Scott county.


Geological Map
OF PARTS OF
LEE, WISE, SCOTT AND WASHINGTON Cos.
VIRGINIA.
by
J. J. Stevenson.
1880.
1 Coal Measures
2 Quinnimont Group
3 Lower Carboniferous
4 Devonian
5 Upper Silurian
6 Lower Silurian
A — Poor Valley Fault
B — Wallen Valley Fault
C — Pattonsville Fault
D — Hunter Valley Fault — Clinch uplift
E — Copper Cr. Fault
F — Holston Fault
G — Walker Mt. Fault
Scale 5 miles to one Inch.
KENTUCKY
VIRGINIA
TENNESSEE
Little Stone Gap
Big Stone Gap
Pennington Gap
Imboden
POWELL MOUNTAIN
Stock Creek
COPPER RIDGE
Copper Creek
MOCCASIN RIDGE
Moccasin Creek
Mendota
WALKER MOUNTAIN
JONESVILLE
Powell River
WALLEN RIDGE
POWELL MOUNTAIN
North Fork of Clinch River
Clinch River
CLINCH MOUNTAIN
ESTILLVILLE
B.C.&I. V.G. Railroad
North Fork of Holston
BRISTOL
Norfolk & Western Railway (A.M.&O.R.R.)
E.T.Va.&Ga. R.R.
T Sinclair & Son Lith.

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the Wallen Valley fault; the Clinch River uplift is crossed by the North Fork of Clinch, by Stock creek, by both branches of Cove creek and by several forks of Stony creek; Copper Creek fault is crossed by Clinch river, and Copper creek in its windings crosses it several times; the Holston fault is crossed by a stream entering the river near the mouth of Moccasin creek and by Abraham creek; while the Walker mountain fault is crossed by the stream along which the railroad passes through the mountain.

II. General Description of the Groups.—The section exposed within the region examined extends from the Coal Measures to the base of the Knox group as recognized by Prof. Safford in Tennessee. Lower rocks are reached in the Great Valley of Virginia, which is drained by the South Fork of Holston river, but the reconnaissance stopped at Walker Mountain on the northerly side of the Valley. Some of the groups show peculiarities not observed by Profs. Lesley and Fontaine in the area further east or by Prof. Safford in Tennessee.

The Upper Carboniferous is represented by the Coal Measures and the Quinnimont group or Seral (Pottsville) Conglomerate.

The Coal Measures.—The Coal Measures are found north from Stone mountain, and extend beyond Black mountain into Kentucky. Their thickness, as determined partly by estimate but mostly by barometric measurement, is not far from 2,000 feet along Roaring Fork of Powell river and its tributary, Calahan creek; but the highest part of Black mountain was not reached, since, according to Mr. Moore's barometic determination, the summit of that mountain at the head of Looney branch is 2,200 feet above the Poor branch of Cumberland river; so that the thickness of Coal Measures is not less than 2,500 feet, or somewhat less than that observed in the southwestern part of Pennsylvania. There was no opportunity during the recent reconnaissance to complete the detailed section of these measures, and the highest 500 feet of the section given in the former memoir still remains unexamined in detail.

This area is not more than ten miles wide, for, according to the report on Mr. Moore's reconnaissance, already referred to, the Coal Measures are cut off in Kentucky by the Pine Mountain fault. The basin begins in Tennessee, where it forms Prof. Safford's northeastern division of the coalfield, and occupies the high lands of Morgan, Anderson Scott, Campbell and Claiborne counties, north from the Emory river and east from a line passing through Huntsville and Montgomery. Prof. Safford found there 2,100 feet of measures, in which *nine* beds of *coal* were seen, varying from one to six feet in thickness. These beds of the northeastern district are, in part at least, above those of the other districts of the Tennessee coalfield, which belong not to the Coal Measures, as understood in other States, but to the Quinnimont group of Fontaine, which is equivalent to the Seral Conglomerate of Rogers.

No junction was made in the Wise county coalfield between the work done by Prof. Lesley and that done by the writer; a gap of five miles remains yet to be filled. But there is no reason to doubt that, for the most part, the beds described by Prof. Lesley belong to the Coal Measures, and not to the Quinnimont group; as, indeed, Prof. Lesley has suggested His hesitation with reference to their exact position arose in a measure from the coarseness of the Coal Measures sandstones, some of which are decidedly conglomerate.

The section observed on the headwaters of Powell river contains twenty-one coal beds, seen, varying in thickness from three inches to almost fifteen feet. No limestone was found in the section, aside from a few nodules, and those are ferruginous. The prevail ing rock is sandstone, and the shales, a small part of the column are almost invariably sandy. The sandstones vary from fine grained to conglomerate, with pebbles rarely larger than a chestnut, and usually not larger than a pea. The thickness of the lower or productive portion is about 920 feet.

As the available coal occurs in what is equivalent to the Lower Productive Coal series of Pennsylvania, it might be supposed that valuable beds should be looked for in the upper part of the section, where the Upper Productive Coal series of Pennsylvania ought to be represented. It is not likely that any such beds will be found. The coal beds of the upper group lose their importance southwestwardly, so that, for example, the *Pittsburg bed* which in southwestern Pennsylvania attains to a thickness of from 9 to 12 feet, becomes thin and poor on the Kanawha river of West Virginia. The diminution in thickness and deterioration in quality is so regular along the line of nearly 200 miles, that there is every reason to believe that it continues southward until the bed becomes utterly worthless.

Some of the coal beds in this field are of decided excellence, showing barely one half of one per cent of sulphur, and from .75 of one per cent to less than 4 per cent of ash. One large bed yields an excellent coking coal, which will prove of immense advantage in the development of the iron ores in southwest Virginia and northwest North Carolina.

The Quinnimont Group or Seral (Pottsville) Conglomerate.—This group was observed along Stone mountain from the Little Stone gap to beyond Pennington gap, and Mr. Moore describes it as making part of that ridge to beyond the Tennessee line. Its beds are thrown over at a high angle, varying from 80° to 90°, and its area is not materially wider than the thickness of the group. The same group occurs also on the easterly portion of Powell mountain.

This group is not far from 1,000 feet thick, and is made up of sandstones, shales and coal beds. The highest stratum is a sandstone, known as the "Bee rock," which is not far from 135 feet thick, and is a marked feature along the northerly side of Stone mountain from Little Stone to Pennington gap. This bed is more or less conglomerate. The lowest bed, also, is conglomerate, and is about 45 feet thick. Sandstones and conglomerates prevail, and some of the latter are very coarse. Six coal beds were seen in Pennington gap and a seventh was found on Powell mountain.

The coal beds are variable in thickness, and in the quality of their coal, so that none of them attains to real economic importance. Those in Stone mountain have suffered severe crushing, and are apt to be pockety. The best is that which immediately underlies the "Bee rock," and varies from one to three feet. The same bed is even more irregular on the southerly face of Powell mountain, where its thickness is from 2 to 14 inches. A second bed of workable thickness was seen in Powell mountain, but it is concealed in both Big Stone and Pennington gaps. This, at not far from 350 feet below the top of the group, is from 2 to 3 feet thick, and seems to hold a place very nearly like that which is mined for coking at Quinnimont. In Powell mountain, however, the coal is sulphurous, and can be used only for domestic purposes.

The coal beds in the greater part of the Tennessee coalfield belong to this group, and, without doubt, much of the section obtained in the northeastern district of that coalfield should be referred to the same horizon, as Prof. Safford has done. The coal beds there are somewhat variable. A noteworthy feature of this group in Tennessee is that the bottom plate of conglomerate is absent, and the Coal group passes directly into the Lower Carboniferous.

The Lower Carboniferous.—The two divisions of Lower Carboniferous recognized in Tennessee by Prof. Safford, and named by him the *Mountain Limestone* and *Silicious* groups, are fully represented here. These names are used in this memoir in preference to those now used in Pennsylvania, because in this region, the old division of Lower Carboniferous into Umbral and Vespertine or Nos. XI and X would place all the limestones together, and thereby do violence to the actual relations of the beds.

The beds of this series are well shown along Stone mountain; on the bluff of Powell mountain overlooking the valleys of North Fork of Clinch, and the South Fork of Powell river, and in Brushy mountain near the North Fork of Holston river.

The Mountain Limestone Group.—This group exhibits some surprising variations. Along Stone mountain, the section as shown in Pennington gap is:

1. Shales and sandstones, with some thin limestones . . 705′
2. Limestones and calcareous shales . . . . . 150′

under which comes the massive limestone of the Silicious group. But in Brushy mountain, where the exposures are almost complete, the section is:

1. Shales and sandstones, with thin limestones . . . . 800′
2. Limestones and calcareous shales . . . . . 1470′

No measurements were made on Powell mountain, but the thickness of the group is not materially different from that shown in the Stone mountain gaps. The succession is complete on the Holston, and the exposures are so good that there is not the slightest reason to suspect a fault; as, indeed, will be apparent to any one who will consult the detailed section given in the chapter on the Holston area. The shales and sandstones on top are more or less calcareous; some of the sandstones are almost sky-blue, and they break with an irregular fracture; others are calcareous grits, but there are some which are comparatively soft. Several beds are used for the manufacture of hones and grindstones. This part of the group is well shown in Pennington gap, when the river is low. It is exposed also in the Wolf creek gorge which is followed from Holston river by the Bristol Narrow-Gauge Railroad.

The greater part of the lower division in Stone mountain consists of calcareous shale, there being comparatively little limestone; but in Brushy mountain, there is very little shale, and many of the limestone beds are remarkably free from foreign matter; chert

occurs in small quantity in some of the lower beds both in Stone mountain and near the Holston.

Fossils characteristic of the *Chester* limestone occur plentifully in some beds at all localities. *Pentremites godonii*, *Productus semi-reticulatus* and an undetermined *Zaphrentis* were found in Hunter valley; *Productus semi-reticulatus*, *Hemipronites crassus*, *Spirifera leidyi*, *Athyris subquadrata*, *Cyrtoceras*, *Fenestella* and *Zaphrentis spinulifera* were obtained in Pennington gap; in Brushy mountain the stems of crinoids and *Chonetes* are common in some of the shale beds of the upper part of the group. The higher li estones are made up mostly of a *Fenestella*, with occasionally a *Zaphrentis* or a *Productus;* while in the lower limestones crinoid stems, *Fenestella*, *Zaphrentis*, *Productus cora*, *Productus elegans*, *Spirifera leidyi*, *Athyris subquadrata*, *Pinna missouriensis?*, and *Allorisma* are very common, along with other forms not recognized during the hurried examination.

The Silicious Group.—In Tennessee, according to Prof. Safford's statement, this group is double, consisting of:

1. The *Lithostrotion* or coral bed, a cherty limestone, fossiliferous and everywhere characterized by *Lithostrotion canadense*.
2. The Lower or Protean member, variable, mostly silico-calcareous; often limestone; often sky-blue; contains much chert in its middle and lower portions; sometimes beds of crinoidal limestones.

This division is easily recognized in middle Tennessee, but the distinction is not so clear in eastern Tennessee. "So far as its presentation in East Tennessee is concerned, no division is practiable."

Within the area under consideration, the group is double. It is shown in the gaps of Stone mountain and is well exposed near the North Fork of Holston river along the line of the Bristol Narrow-Gauge Railway Company. The section at Pennington gap is:

1. Cherty limestone . . . . . 200′
2. Reddish silicious beds, some of them blue on fresh surface, some shale . . . . . 150′

The lower member was identified by Mr. Moore, who has visited this gap, with the Protean member of the Knobstone of Kentucky. The limstone is well exposed both here and in Big Stone gap, and at both localities it contains much chert in nodules, sometimes as large as a melon. The change in this group is as striking as that observed in the Mountain Limestone group and the section near the North Fork of Holston is as follows:

1. Limestone and shale . . . . . 655′
2. Calcareous sandstone and shale . . . . . 100′

Several of the limestone beds hold very much chert, in layers and nodules, but the quantity is comparatively small in the lower beds, one of which is almost free from it. The lower member of the group consists of sky-blue grits, breaking with irregular fracture, and some yellow shales in which is a carbonaceous layer. The exposure is not wholly complete and between 30 and 40 feet of the upper part of the shale is concealed. The top layers for about 10 feet are fairly well shown in the railroad side-cutting. A *coal bed* may belong in the concealed interval, as *coal* is said to have been digged in the bed of the river almost directly opposite to this concealed space.

The only trace of fossils found in the lower member was a fragment of what seemed to be *Leiorhynchus;* no *Lithostrotion* was seen in the upper member, but *Productus* and *Athyris* are common, as are also crinoid stems and bryozoans. These may be collected either in Stone or in Brushy mountain. The chert often replace *Productus*.

The Protean member of the Silicious group shows some interesting variations; Prof. Fontaine obtained the following section on the Greenbrier river of West Virginia:

1. An upper member consisting almost entirely of red marlites . . . . . 250′
2. A middle member characterized by predominance of gray sandstones, containing *coal* . . . . . 350′
3. A lower member, characterized by silicious sandstones and conglomerate. The thickness exposed 60′. With this should probably be counted 500′ of underlying more silicious flags, total . . . . . 560′

There is no room for doubting the identity of this section with the Protean group, for Prof. Fontaine obtained *Lithostrotion canadense* from the limestone near Lewisburg, West Virginia. The red shales underlying the limestone unquestionably belong not with the limestone, but with the underlying shales and sandstones. In Brush mountain and its vicinity in Montgomery county, Prof. Fontaine found:

The upper member . . . . . 1,090′
The middle member . . . . . 670′
The lower member . . . . . 930′

In all 2,690′ instead of 1,160 as on the Greenbrier river. *Coal beds* occur in both sections. But where the line of the Bristol Railroad reaches Brushy mountain very near the border line between Scott and Washington counties, this great mass has diminished to barely a 100′, its *coals* have disappeared and there remains of it nothing but some shales and shaly sandstones, most of them more or less calcareous. In eastern Tennessee the distinction between the Protean and the Upper member is obscure, owing probably to increase of limestone in the lower member.

The Devonian.—This is represented by the Chemung and Hamilton. The Corniferous and Catskill are absent.

The full section of the Devonian was seen only in Brushy mountain and the Poor valley between that and Clinch mountain. The first ridge of Brushy mountain is composed of Devonian rocks, and very fair exposures of the series can be found along lines running from the foot of Clinch mountain through the numerous gaps in that ridge. The succession is:

Chemung . . . . . 300′
Hamilton . . . . . 830′

But in the Poor valley of Stone mountain and along the face of Powell mountain, the Chemung and much of the Hamilton are wanting, so that the rocks of the Silicious group rest directly on the lower Hamilton shales.

The Chemung, as shown along Brushy mountain, between Moccasin gap of Clinch and the railroad bridge over North Fork of Holston, consists of irregularly bedded sandstones and shales, containing more or less of nodular clay iron-stone and some dark shale. Fossils are not very numerous, but two thin layers associated with conglomerate bands show characteristic Chemung species, *Spirifera disjuncta* and *Productella boydii* along with *Chonetes* and other which could not be obtained in good enough condition for identification. *Spirophyton* occurs plentifully in the lower beds. These rocks are well exposed along the railroad excavations between Mendota and the Holston bridge.

The Hamilton is triple, dark shales on top, yellow sandy shales in the middle, and black more or less carbonaceous shales below; thus showing the general divisions observed in New York and Pennsylvania. All three of the divisions were seen in the Poor valley and Brushy mountain; but in the vicinity of Stone mountain and of the North Fork of Clinch river, only the lower black shales were found. The thickness of these near Stone mountain is probably not more than 125 or 150 feet, while at one locality it is certainly less. The lower shales are often very rich in carbonaceous matter and two beds near the base have been mistaken for *coal* beds. Iron pyrites occurs plentifully in these lower shales at all localities and alum incrustations are common. A fine-grained, nearly white sandstone is shown at several places near the base of the group; it is a good firestone and has been hauled nearly forty miles by wagon, for use as furnace lining.

Few fossils were seen in the Hamilton; a *Chonetes* occurs plentifully in the upper shales and imperfect specimens of *Lingula* were found in the lower shales. These Hamilton beds are the black shales described in Prof. Safford's report on Tennessee.

The Upper Silurian.—This is represented by the Oriskany, Lower Helderberg, Clinton and Medina; the Niagara and the Oneida Conglomerate were not recognized.

The Oriskany is a sandstone, probably not more than 35 or 40 feet thick, which is shown in the Poor valley of Powell river, along the valleys of Wildcat creek and the North Fork of Clinch; also along the latter stream at the foot of Powell mountain, and in the Hunter valley at Stony creek. It is absent along the southerly foot of Clinch mountain, where, indeed, the Upper Silurian is represented only by the Medina and a small part of the Lower Helderberg.

The Oriskany sandstone is coarse, reddish on exposed surface but white on the fresh surface. It is friable, and at some localities, notably along the North Fork of Clinch river, it readily disintegrates on exposure. Very possibly the upper ore-horizon along Wildcat creek and the North Fork of Clinch river may belong in part to this sandstone. This rock contains *Streptorhynchus hipparionyx* on Stony creek; in the Poor valley of Powell river, it contains *Merista lata*, but with that there occur some forms belonging to the Lower Helderberg, so that in the writer's previous memoir the sandstone was referred to the lower group. The relation between the groups is very close throughout this region.

The Lower Helderberg.—This group accompanies the Oriskany. In a general way its characteristics are very similar to those of the same group in New York. The *Leperditia* bed at the base is shown near Big Stone gap. Below this is a coarse sandstone like the Oriskany, which is shown at some localities along Powell river, and is well exposed along the line of the Pattonsville fault. The group

closes with a limestone, which frequently becomes silicious. It is occasionally fossiliferous and the species are very characteristic.

The lower sandstone of this group is ferriferous and occasionally holds a brown hematite of excellent quality. A fossiliferous brown hematite was seen at the southerly foot of Clinch mountain, which, in all probability, should be referred to this group.

The Clinton.—Prof. Safford has found in Tennessee above the Clinton group a limestone, which he regards as representing the Niagara group of New York; but no traces of that limestone were observed by the writer, unless the fragments seen on the Jonesville and Gladesville pike and belonging in the concealed interval between rocks of Clinton, and those of Lower Helderberg age, may be referred to it. Elsewhere no bed was seen which could be regarded as representing the Niagara group.

The Clinton group is present in Poor Valley ridge; on both Wallen ridge and Powell mountain; and at two localities along the northerly side of Buckner ridge; but it is absent from the southerly side of Clinch mountain. The structure of that ridge is shown in Moccasin gap, where the Medina sandstone underlies the Lower Helderberg, on which the Hamilton shales rest.

No full section of the Clinton group was obtained, but its thickness cannot be far from 700 feet. The rocks are sandstones and sandy shales, but a calcareous sandstone, 60 feet thick, and containing thin bands of very fair limestone, occurs near the middle of the group. Three beds of the fossiliferous ore were seen, and, according to Mr. Pennington, who owns the forge in the gap which bears his name, two others exist, but they are very thin. The three beds belong below the middle of the group. The lower two are not far from 50 feet apart, but the interval to the upper bed is somewhat greater. These intervals show considerable variation in Poor Valley ridge, where the ore has been opened at several localities. Two beds were seen on the southerly slope of Wallen ridge and three on Powell mountain; while only two are exposed in Hunter valley. The most important bed is the middle one, which usually carries excellent ore. The others vary much in thickness and quality of the ore.

The Medina Sandstone.—This is a salient feature of the region, as it forms the crest line of Wallen ridge, Powell mountain and Clinch mountain. For the most part, it is a massive, fine-grained and very hard sandstone, but it has some layers of conglomerate, which are most numerous near the top. On Clinch mountain it is divided by bands of shale in which brown hematite occurs. On Powell mountain and Wallen ridge it graduates upward into a reddish sandstone which may represent the White-oak sandstone of Prof. Safford's report though the writer is inclined to regard it as part of the Clinton or Dyestone group; the total thickness as observed on the several ridges does not exceed 400 feet. No fossils were seen other than casts of the characteristic fucoid.

The Lower Silurian.—This is represented by Formations II and III of the Virginia column A more convenient division for description is that made by Prof. Safford into the Knox and the Trenton and Nashville groups. The Knox group includes all but the upper part of No. II, or the Chazy of New York, which is placed by Prof. Safford in his higher group.

These groups are exposed over a great part of the area; they are the surface rocks in the great Powell valley between Poor Valley ridge and Wallen ridge; they are shown in the southerly side of Wallen valley and the northerly side of Powell mountain; they extend unbroken from the Hunter Valley fault to the crest of Clinch mountain; and again from Holston fault to the Valley of Virginia. Detailed study of these groups could not be made; they are faulted and folded in the most perplexing manner, so that in the course of a day's ride across the country one passes again and again over the outcrop of the same beds. But the general features of the higher group and the upper part of the lower can be worked out somewhat rapidly in Moccasin ridge, where the dip is apparently unbroken by a fault. The lower parts of the Knox group are shown in Buckner ridge.

The Trenton and Nashville Group.—This embraces the Hudson, Trenton and Chazy groups of New York. It is well shown in Powell valley, in Wallen valley, and on the southerly slopes of Copper and Maccosin ridges. A section was obtained in the vicinity of Estillville, Scott county, which is:

1. Shales with thin limestone, calcareous at the base . . 755′
2. Limestones and shales . . . . . 430′

thus giving a thickness of 1,185 feet for the series. A detailed description is given in the chapter on the area drained by Clinch river The thickness of the shales is nearly the same on the northerly side of Wallen ridge, where they are well exposed They are black and more or less fissile at the base, but higher up the color becomes brownish to reddish brown, and the rock is in thick layers. The change to the Medina sandstone is well shown on the crest of Powell mountain, where it is abrupt. A great limestone lies at the base of the group; it is massive, occurs in beds from 10 to 20 feet thick, which are separated by thinner beds of shale. Many of these limestone beds yield a beautiful marble, which is equal to any from the typical localities in Tennessee.

Fossils are abundant in many parts of the section.

The Knox Group.—As in Tennessee, this group is triple; the upper division, consisting of cherty limestones and dolomites, is well exposed in Moccasin and Copper ridges, the middle or shaly division and the lower, consisting of calcareous sandstones, are shown in Buckner ridge and near Clinch river.

The section of the upper division, as obtained in Moccasin ridge may not be complete, part of it having been obtained on one road and part of it on another; there may be a gap of nearly 300 feet. The estimated thickness is about 1,750 feet. In the upper half the limestones are more or less dolomitic and contain much chert, so much, that in three great beds the chert predominates. These beds are ridge-making, and they crown the summits of the several subordinate ridges in both Copper and Moccasin ridges. These cherty beds, too, are iron-bearing, and each of them carries extensive deposits of brown hematite, some of which have been explored. The lowest bed of this division is a calcareous sandstone very similar to that at the base of the group.

The middle division consists mostly of shales, with which are beds of impure limestone, more or less silicious and varying from 2 to 10 feet in thickness. This is shown along Clinch river at many places, as well as along Stock creek and along the Jonesville and Estillville road as it passes from the North Fork of Clinch river to the mouth of Stock creek.

The lower division is a mass of calcareous sandstone and sandy limestones with some shale, the whole containing great quantities of iron pyrites, which makes up fully one-fifth of the whole mass of some beds. This mineral occurs in irregular laminæ often one-fourth of an inch thick, which sometimes make a network on the exposed surface of the rock. This division is well exposed along the whole line of the Hunter Valley or Clinch uplift within the region examined.

The compositon of the Knox group here is approximately as follows:

1. Limestones, shales and chert beds . . . . . 1,750′
2. Shales and limestones . . . . . 1,000′
3. Calcareous sandstones, pyritiferous . . . . . 500′

Thus giving for the whole group a thickness of not far from 3,250 ft.

(To be Continued.)

The Coal and Coke Movement over the Chesapeake and Ohio R'y, for the month of January, 1881, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Charles M. Gibson, the Fuel Agent for the company, were as follows:

	1880.	1881.
Fuel for use of Company	10,597	12,898
Shipped at Huntington on the Ohio river	13,142	2,504
Delivered on line of Elizabeth, Lex'n & Big Sandy Railroad.		972
" " Chesapeake & Ohio R'y. west of Richmond	2,590	12,397
" at Williamson to Richmond & Alleghany Railroad.		14
" Staunton to Balt. & Ohio Railroad, Valley Division	76	74
" Waynesboro to Shenandoah Valley Railroad....		102
" Charlottesville to Va. Midland R'y	4,222	5,519
" Gordonsville to do. do.		145
" Hanover Junc. to R. F. & P. Railroad	1,072	2,588
" Richmond for consumption, including steam-tugs and dredges	6,831	6,861
Shipped at James River wharves	6,422	9,387
" Newport-News wharves		
Total	44,952	53,461

The increase in the total movement in January, 1881, over January, 1880, was over 19 per cent. It would have been much greater but for the unprecedented severity of the weather.

The character of the fuel moved during the same periods, is shown in the following exhibit:

From January 1st	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Total.
For the month of Jan., 1881,	446	18,091	11,883	18,468	4,573	53,461
" " " 1880,	3,565	.....	39,616	.....	1,771	44,952
Increase, 1881	.....	.....	8,826	.....	2,802	8,509
Decrease, "	3,119	.....	.....	.....	.....	.....

In the "New River and other steam coals" is included the product of the Eagle, and Gauley Mountain mines.

The increase in the coke movement was over 158 per cent, largely in consequence of the demands of blast furnaces on the line of the railway.

The Upper Freeport Coal Bed along Laurel Ridge in Preston County, West Virginia.

By JOHN J. STEVENSON, Professor of Geology in the University of the City of New York.

(*Read before the American Philosophical Society, February 4, 1881.*)

Laurel ridge, the easterly boundary of Ligonier valley in Pennsylvania, enters West Virginia at or very near the northwestern corner of Preston county. It is a bold anticlinal, which in Indiana, Westmoreland and Fayette counties of Pennsylvania, as well as in Preston and Barbour counties of West Virginia, exposes the bottom of the Lower Carboniferous, and at some localities brings up the Chemung rocks, while the Conglomerate and the Lower Productive Coal group, the Allegheny series of Lesley, are shown on its sides. The fold is cut transversely by several deep gaps in Pennsylvania, where it shows no longitudinal valleys of considerable extent; but in Preston county of West Virginia it is divided longitudinally by Cheat river, whose gorge is one of the most noteworthy attractions of the Baltimore and Ohio Railroad.

A strip, extending nearly 12 miles along the westerly slope of the ridge in Preston county, and divided by the Baltimore and Ohio Railroad, was visited by the writer in December, 1880.

The Upper Freeport Coal Bed, the most important member of the Lower Productive Coal group, presents some features there which may be deserving of note.

The easterly outcrop of that bed is crossed by the railroad at probably two miles eastward from Tunnelton station, and there, on the Graham-Beall estate, an old opening was examined which showed the following section:

1.	Mahoning sandstone . .	not measured
2.	Shale	0′ 3″
3.	*Coal*	3′ 10″
4.	Clay	0′ 2″
5.	*Coal*	1′ 8″

But the exposure at the bottom is not complete, for, underlying the measured portion, is some good coal, and still lower is a considerable thickness of impure slaty coal, which is not worth digging. The coal, as far as exposed, is very good, more or less prismatic, very soft and easily mined. For the most part it is clean, but thin streaks of pyrites occur in the top 10″, and minute scales of the same mineral appear occasionally in the bottom 8″. Above the coal and separated from it by but 2 or 3 inches of shale is the hard gray Mahoning sandstone, which lies in thick beds and forms an excellent roof. The exposure of this rock does not give the thickness of the bed.

The sandstone is well shown along the railroad between this place and Tunnelton. Owing to the crookedness of the road, the bottom of the rock is sometimes below, sometimes above the track, but rarely many feet either the one way or the other. Frequently, however, the coal is at track-level, and at Tunnelton it is far enough above that to be worked. It descends toward the tunnel beyond the station, but in the tunnel it rises again so as to form the roof at the westerly end. Thence, however, the course of the road follows the dip of the rocks, and the coal soon comes down to the track-level, where it is mined and shows the following section:

Coal	2′ 8″
Clay	0′ 2″
Coal	2′ 8″

The exposure is incomplete at the top, but reaches very nearly to the bottom of the good coal. The slaty division below is said to be not far from 3 feet, in which case the full thickness of the bed is about 9 feet 6 inches. The quality of the measured coal here is similar to that of the coal seen at the Graham-Beall pit. Eight inches of the slaty coal were seen. It contains some good splint, but for the most part it appears to be worthless. The roof at this pit is shale, which varies in thickness from 2 inches to 12 feet; but it is hard, and makes a very good roof. The Mahoning sandstone is shown in the hill above this pit.

Within one-fourth of a mile from this opening, the railroad crosses a deep gorge in which the coal bed is exposed below the track with several feet of shale between it and the Mahoning sandstone, which forms a bluff on each side of the gorge. The thickness of the shale varies abruptly, and the limits seem to be as given above. From this ravine, the coal rises until at Austin station it is above the track, and at half a mile further it is mined and coked by the Austin Mining Company.

The outcrop of the bed is easily followed southward from the railroad, and lies at but a little way eastward from the ridge-road leading from Tunnelton to the Northwestern turnpike. The coal is reached at that pike. Few of the ravines thus far are deep enough to expose the coal, but that through which Sandy creek runs affords good exposures, and the bed had been opened at several places along that stream.

Beyond the point where the ridge road reaches the pike, at say five miles from Tunnelton, the ravines become deeper and exposures of the bed are numerous. Pits were seen on several farms. In this direction, the bed becomes thicker though it seems hardly to improve in quality. One opening, seen on Mr. Wolf's farm at about eight miles from Tunnelton, shows 11 feet of coal without any persistent parting, though there are many insignificant partings which continue for but a few yards. The coal appears to be more sulphurous here than it is nearer the railroad, and the ash is greater.

The bed was followed northward from the railroad for several miles, but its structure there is similar to that seen in the pits on the railroad. The dip throughout is northwestward, and the undulations with respect to the track are due to curves in the railroad.

The especial feature of the bed here, aside from its thickness, is its freedom from sulphur. In the Ligonier valley of Pennsylvania, according to Mr. McCreath's analyses, the sulphur in *Upper Freeport coal* varies from 1.414 to 4.789, and the coal rarely yields a firm coke. The ash varies from 3 to 6 per cent. Further south, in Upshur and Randolph counties of West Virginia,* the sulphur is high, and the ash is considerable even when the coal is best.

Within the area immediately under consideration, the coal from this bed yields an excellent coke. The Austin Company has found a ready market for its product, which in Chicago competes on even terms with the Connellsville coke. Several car loads of coal from the vicinity of Tunnelton were sent to Connellsville and there coked. Two lots were sent to the Cambria Iron Works, where analyses were made by Mr. Morrell, with the following results:

	(1)	(2)	(3)
Carbon.	92.64	88.05	88.163
Sulphur	0.53	1.41	0.837
Ash	6.82	10.54	10.125
Volatile matter	.....	.....	0.875

(1) Car No. 1, made from *sound coal.* (2) Car No. 2, made from *outcrop coal.* (3) Coke made from coal obtained at another opening was sent to the Edgar Thompson Steel Works, where it was analysed by Mr. S. A. Ford, with these results.

These tests seem to have been sufficiently extensive to determine the value of the coal for coking purposes. The loss in coking, as reported by Mr. M. L. Schaefer, Superintendent of the Austin Company, is about 33 per cent, indicating a composition very nearly like that of the *Pittsburg coal bed* in the Connellsville basin.

It is evident then that the *Upper Freeport coal bed* in this region will yield a coke which is not appreciably inferior to that made at Connellsville, Pennsylvania.

Few details were gathered respecting the general section exposed along the slope of Laurel ridge, as all detailed work was stopped by a severe snow storm. A bed of cannel was seen at not far from 165 feet above the *Upper Freeport.* On one side of Sandy creek, this bed shows 4′ 8″ of cannel, but on the other side of that creek it shows no cannel, and contains only bituminous coal, 3′ 6″ to 4′ thick. The cannel was worked many years ago for distillation of oil, but the works were abandoned on the discovery of petroleum.

The Freeport limestone is present at from 40 to 50 feet below the *Upper Freeport coal bed*, and is exposed at one locality nearly three miles north from the railroad. It is 3 feet thick, and rests on a bed of iron ore, which is 30 inches thick and very persistent. This ore was mined at one time both by benching and drifting, and the material was sent to the Irontown furnace.

*For description of the bed in these counties, see *Notes on the Geology of West Virginia*, by the writer, read before this Society on February 5, 1875.

The Furnaces and Mines of the Southwestern Plateau of the Valley of Virginia in 1880.

The following facts in reference to furnace and mining operations in Pulaski, Wythe, and Smyth counties, Va., for the year 1880, were kindly obtained for THE VIRGINIAS by Mr. D. S. Forney, of Allisonia, who was aided by Mr. John W. Robinson of Graham's Forge and Mr. William Cassedy of Allisonia.

Radford Furnace, Pulaski county, Va., of Radford Iron Co., J. J. Culbertson, lessee and manager, made, in 1880, of charcoal pig iron 930 tons, using 2,325 tons of iron ore, 208 tons of limestone, and 130,200 bushels of charcoal. It employs about 125 men,—miners, wood-choppers, colliers, furnace men, etc. The iron made was sold in Philadelphia, Wilmington, Pittsburg, Providence, etc., and used for car-wheels. At this time (Feb. 5), 150 choppers are at work. A steam pump is to be put up at New river to force water to the "Clark" ore bank, to wash the ore at the "bank."

Rich-hill Iron-ore Property, owned by D. S. Forney, Allisonia, Va., and T. Bumgardner, of Lancaster, Pa., is a noble estate, having very many advantages to offer for the cheap production of a superior quality of pig, bar or other iron,—especially iron for car-wheels. Big and Little Reed Island creeks, rivers more properly, meet on this property and give it several large water-powers, only one of which, that of Little Reed Is'd is now partially used for a Catalan forge, leased by J. L. Crockett, which, with 3 fires, makes, directly from the Rich-hill ores, 100 tons of bar iron, of rare excellence, a year.

At the confluence of these creeks, but a short distance from New river, is one of the very best furnace sites in the country, one having all the "conditions," whenever a railway, "independent," or "loop" line, passes up New river, as it will very soon. Rich Hill, lying in the fork of New river and the united Reed Island creeks, rises to a height of 335 ft. above the general level of the fork bottom, and contains, beyond question, a great quantity of the very remarkable Trenton (?) iron ores of what may very properly be called the Cripple Creek ore-belt.

Tipton Furnace, (called "Boom" by some), on Little Reed Island creek, about a mile above its mouth, in Wythe county, C. W. Lyons, manager, owned by Reed Island Iron Co., is a new one, nearly completed, that will be ready to go into blast this March. It will make, in 1881, from 1,500 to 2,000 tons of cold-blast charcoal iron. Water power is used. The ore beds and limestone quarry are less than half a mile from the furnace. The iron made will either be boated down New river to the A. M. & O. RR., or hauled in wagons to Martin, on same road, at from $3.00 to $3.50 ton. From 75 to 80 men are employed here, representing some 400 people.

Barren Springs Furnace, on New river, J. W. McGavock & Co., owners, J. J. Boker, manager, produced in 1880 about 1,500 tons of cold-blast charcoal iron, using 3,000 tons of ore and 450,000 bushels of charcoal, and employing from 50 to 75 hands, the bread-winners of 300 to 400 people. The pigs were hauled some 14 miles, to Martin Station, at a cost of $3.00 to $3.50 per ton; they were marketed in Baltimore, Wilmington, Cincinnati, Terre Haute, &c., being used for wire rope, chilled rolls, etc. Steam power is used, and the daily capacity of the furnace is 6 to 7 tons. It is now out of blast and at this date no arrangements have been made for running it in 1881.

Cedar Run Furnace, owned by D. P. Graham and operated by Graham & Robinson, was in blast, in 1880, from May 23 to December 23, producing 1,000 tons of cold-blast charcoal pig, similar to that made at Barren Springs Furnace, which was hauled 9 miles to Max Meadows station, at a cost $2.25 to $2.50 per ton, and sent thence to same markets as Barren Springs Furnace iron, and used for same purposes. About 2,500 tons of ore and 400,000 bushels of charcoal were used; from 75 to 100 men were employed, on whom from 400 to 500 people depend. Water-power is used.—This furnace will go into blast again next April, and will make from 1,000 to 1,200 tons of iron in 1881.

Pierce Furnace, on New River, owned by New River Iron & Manufacturing Co., J. A. Dyer, manager, is a new furnace, nearly completed, that will go into blast this March. It will make, in 1881, from 1,800 to 2,000 tons of cold-blast charcoal pig, using from 4,000 to 5,000 tons of ore, from its very extensive and convenient beds, and working 100 to 150 hands, representing from 500 to 600 souls. The iron will be hauled 12 miles, to Max Meadows station, for $3.00 to $3.25 a ton. This company has a large tract of valuable timber and farming land and a magnificent water-power.

Walton Furnace, 5 miles N. W. from Austinville, owned by Lobdell Car-wheel Co., of Wilmington, Del., managed by Peter Gallagher, was in blast from September to December, 1880, and produced 350 to 400 tons of cold-blast charcoal pig. Steam-power is employed. The iron is hauled 8 miles, to Max Meadows station, at a cost of $2.25 to $2.50 per ton. It goes to Wilmington, Del., to Lobdell Car-wheel Co., and is used for car-wheels. This furnace went into blast again January 25, and will make from 1,500 to 2,000 tons of pig in 1881.

Brown Hill Furnace, on Cripple Creek, Wythe Co., Va., 4 miles from Walton Furnace, was rented in 1880 by C. S. Van Liew, agent for Hendricks Brothers, who made an 8-months blast, and produced 1,000 tons of charcoal pig iron, consuming 160,000 bushels of charcoal and employing 8 miners, 8 furnace-men, 70 wood-choppers for 3 months, and 12 four-horse teams. The pigs were shipped to Hendricks Bros., 49 Cliff St., New York, from Max Meadows station, 12 miles from furnace, to which it costs $3 per ton to haul the pigs.—This furnace now belongs to Lobdell Car-wheel Co., which is preparing to put it in blast and make from 1,000 to 1,500 tons in 1881. Water and steam-power both are used.

New River Mineral Co., C. S. Van Liew, formerly from New Jersey, manager and general superintendent, is now erecting a blast furnace near New river, 2 miles from Brown Hill furnace and 2 miles S. W. from Wythe Lead Mines, which it is expected will be put in blast next June. This will be an iron stack, on pillars, 10.5 ft. in the bosh, to make 10 to 12 tons a day. Steam-power will be used.—This company in 1880 mined 40 tons of lead ore, and 60 tons of zinc, sulphuret and carbonate ore. If it had railway facilities so it could procure coal and coke, and transportion, this company would at once erect zinc furnaces.—The metal from this furnace will be hauled 13 miles, to Max Meadows, at a cost of $3.25 to $3.50 ton.

Raven Cliff Furnace, Crockett, Robinson & Tate, owners; 7 miles S. W. from Brown Hill, Wythe county, Va., was in blast 7 months in 1880, producing 1,500 tons of charcoal pig iron, consuming about 192,000 bushels of charcoal. The iron was sent to Baltimore and Knoxville. It will go into blast again in April.

Beverly Furnace, 2 miles S. W. from Raven Cliff, went into blast October 4, 1880, and up to February 1, had made 650 tons of metal. Metal is hauled 8 miles to Crockett station for $2.50 to $2.75 a ton. It will make from 1,500 to 1,800 tons in 1881.

Mercer Iron Co., John S. Noble & Son, of New Jersey, is putting up a new 10-ton furnace, half a mile from Crockett's New Furnace, which is nearly completed and which it expects to put in blast March 1st, making 6 to 7 tons a day.

Wythe Iron Co., Sayers, Oglesby & Co., had its furnace, 4 miles above that of Mercer Iron Co., in blast 10 months in 1880, producing 1,650 tons of metal, which was sent to Baltimore.

Speedwell Furnace, David E. James & Son, proprietors in the vicinity of that of Wythe Iron Co., was in blast 6 months in 1880, and made 250 tons of iron.

White Rock Furnace, of Lobdell Car-wheel Co., Wilmington, Del., 5 miles S. W. from Speedwell Furnace, was not in blast in 1880, but it is expected will be put in blast the coming spring.

Rye Valley Furnace.—Col. Sayers is preparing to build a new furnace in Rye Valley, some 8 or 10 miles west of White Rock furnace.

It a fact worth mentioning that Rich-hill, Tipton, Hurst, Sayers, Barren Springs, Cedar Run, Bertha, Falling Cliff and Pierce mines, are all embraced in a circle of territory less than 8 miles in diameter; and more mines could be opened, for the ore-bearing beds, in undulated or nearly horizontal stratification, occupy about the same general level and these outcrop wherever the country is denuded to and below that level, as in the ravines or along the stream-valleys, making mining inexpensive.

Among the advantages of this region for iron making may be named its abundance of excellent limestone for flux in proximity to the iron ores, and the beds of steatite, not far away, for in-walls and hearths.

Mr. John W. Robinson, of Graham's Forge, one of the leading spirits in all the iron enterprises of this region, a gentleman thoroughly well informed in reference to the district itself and to all that is going on in it, says, in his letter communicating many of the facts here given: "A line of railroad running up New river to mouth of Little Reed Island creek, thence to the Lead mines *via* Zinc mines and on up Cripple creek and extending on to Ore Knob, would take in all the furnaces and open up a continuous belt of iron ores.

Mineral Traffic of the Atlantic, Mississippi & Ohio RR.—We are indebted to Col. E. E. Portlock, auditor of this Virginia railroad, for the following returns, in tons of 2,000 lbs., of the mineral traffic of that road:

1. For the months of October, November and December, 1880, the last quarter in that year, in continuance of the report in THE VIRGINIAS for November, 1880, by substances and their destinations, as follows:

Pig Lead, from Virginia, 163 tons,—142 to Boston, 10 to Baltimore, 10 to Philadelphia, 1 to way stations. From beyond Bristol came 25 tons. Total movement 188 tons.

Baryles, from Virginia, 555 tons,—27 to Boston, 276 to New York, 252 to Philadelphia. From beyond Bristol 10 tons. Total movement 565 tons.

Marble, from beyond Bristol, 1,105 tons.

Ores (copper, lead and iron), from Virginia,—1 to Philadelphia, 214 to Lynchburg. The latter probably the first iron ore to market from mines of Bedford Company. Total movement 215 tons.

Copper Ingots, from Virginia, 82 tons, all to New York,—from beyond Bristol 1. Total movement, 83 tons

Pig Iron, from Virginia, 2,397 tons,—112 to New York, 1,400 to Baltimore, 575 to Philadelphia, 24 to Lynchburg, 117 to Richmond, 13 to way stations, 156 to Southern States. From beyond Bristol, 94. Total movement, 2,491 tons.

Zinc Ore, from Virginia, 94 tons,—72 to New York, 12 to Philadelphia and 10 to way stations. From beyond Bristol, 180 tons. Total movement, 274 tons.

Zinc Spelter, 10 tons, from Virginia, to Baltimore.

Coal, from Virginia, 2,794 tons,—278 to Lynchburg, 32 to Richmond, 2,484 to way stations. From beyond Bristol, 609 tons. Total movement, 3,403 tons.

Manganese, from beyond Bristol, 810 tons.

Salt, from Virginia, to Southern States, 2,543 tons.

Plaster, from Virginia, to Southern States, 89 tons.

The aggregate movement was 8,942 tons from Virginia, and 2,834 from beyond Bristol,—total 11,776; of which 169 were to Boston, 542 to New York, 1,420 to Baltimore, 850 to Philadelphia, 516 to Lynchburg, 149 to Richmond, 2,508 to way stations, and 2,788 to Southern States.

2. For the years 1879 and 1880, the movement, etc., was as follows:

Pig Lead.—In 1879, from Virginia, 160 tons,—49 to Boston, 42 to New York, 40 to Baltimore, 29 to Philadelphia; 23 from beyond Bristol; total, 183.—In 1880, from Virginia, 464 tons,—247 to Boston, 66 to New York, 62 to Baltimore, 10 to Philadelphia, 1 to way stations, 78 to Richmond; 25 from beyond Bristol; total, 489.—Gain of 306 tons, or over 167 per cent, in 1880.

Baryles.—In 1879, from Virginia, 2,063 tons,—84 to Boston, 1,274 to New York, 127 to Baltimore, 678 to Philadelphia; 116 from beyond Bristol; total, 2,179.—In 1880, from Virginia, 2,323 tons,—186 to Boston, 1,062 to New York, 54 to Baltimore, 1,021 to Philadelphia; 232 from beyond Bristol; total, 2,555.—Gain of 376 tons, or about 17 per cent.

Copper Ingots.—In 1879, from Virginia, 723 tons, all to New York; 292 from beyond Bristol; total, 1,015.—In 1880, from Virginia, 450 tons,—400 to New York, 50 to Baltimore.—Loss of 565 tons, partly in consequence of the discontinuance of the Union Copper Co., of Cleveland, Tenn.

Pig Iron.—In 1879, from Virginia, 2,948 tons,—2,533 to Baltimore, 324 to Philadelphia, 54 to Lynchburg, 7 to way stations, 17 to Richmond, 13 to Southern States; 556 from beyond Bristol; total, 3,504.—In 1880, from Virginia, 7,247 tons,—258 to New York, 4,314 to Baltimore, 877 to Philadelphia, 64 to Lynchburg, 14 to way stations, 10 to Norfolk, 655 to Richmond, 369 to Southern States; 686 from beyond Bristol; total, 7,247.—Gain of 3,743 tons, or over 106 per cent.

Zinc Ore.—In 1879, from Virginia, 3 tons to Philadelphia; 1,599 from beyond Bristol; total, 1,602.—In 1880, from Virginia, 119 tons,—84 to New York, 13 to Baltimore, 12 to Philadelphia, 10 to way stations; 2,088 from beyond Bristol; total, 2,207.—Gain 605 tons, or over 37 per cent on whole movement, but 40 times as much from Virginia.

Zinc Spelter.—In 1879, none transported.—In 1880, from Virginia, 139 tons,—10 to Boston, 94 to New York, 10 to Baltimore, 25 to Philadelphia.—The Zinc furnaces at Martin, Pulaski Co., Va., went into blast in 1880, and then began the first shipments of spelter from the South.

Coal.—In 1879, from Virginia, 4,002 tons,—495 to Lynchburg, 3,507 to way stations; 703 from beyond Bristol; total, 4,705.—In 1880, from Virginia, 5,800 tons,—10 to New York, 468 to Lynchburg, 5,290 to way stations, 32 to Richmond, 3,411 from beyond Bristol; total, 9,211.—Gain 4,506 tons, or over 95 per cent.

Salt.—In 1879, from Virginia, 9,690 tons,—1,194 to way stations, 24 to Norfolk, 4 to Richmond, 8,468 to Southern States; 25 from beyond Bristol; total, 9,715.—In 1880, from Virginia, 8,203 tons,—863 to way stations, 7,340 to Southern States; 33 from beyond Bristol; total, 8,236.—Loss, 1,479 tons.

Plaster.—In 1879, from Virginia, 3,812 tons,—2,442 to way stations, 1 to Norfolk, 1,369 to Southern States.—In 1880, from Virginia, 4,016 tons,—2,311 to way stations, 12 to Richmond, 12 to Virginia Midland RR., 1,681 to Southern States.—Gain 204 tons, or about 5 per cent.

Manganese.—In 1879, from Virginia, 10 tons to Norfolk; 119 from beyond Bristol; total, 129.—In 1880, from Virginia, 16 tons to Norfolk; 1,320 tons from beyond Bristol; total, 1836.—Gain, 1,207 tons.

Marble.—In 1879, from beyond Bristol, 1,777 tons.—In 1880, from Virginia, 10 tons to Boston, 3,502 from beyond Bristol; total, 3,512.—Gain, 1,735 tons, or nearly 100 per cent.

Ores of Copper, Lead and Iron.—In 1879, from Virginia, 6 tons,—3 to New York, 3 to Baltimore; 53 from beyond Bristol; total, 59.—In 1880, from Virginia, 666 tons,—24 to Boston, 2 to Philadelphia, 214 to Lynchburg, 426 to way stations; 1 from beyond Bristol; total, 667 tons.—Gain, 608 tons, or over 1,000 per cent.

The Total Movement, in 1879, was 28,680 tons, of which 23,417 were from Virginia, and 5,263 from beyond; in 1880 it was 40,065 tons, of which 28,767 were from Virginia, and 11,298 from beyond.—Gain was 11,385 tons, or about 40 per cent.

The tons to each point were:—To Boston, 133 in 1879 and 477 in 1880; to New York, 2,042 in 1879 and 1,974 in 1880; to Baltimore, 2,603 in 1879 and 4,503 in 1880; to Philadelphia 1,034 in 1879 and 1,947 in 1880; to Lynchburg, 549 in 1879, and 746 in 1880; to way stations, 7,150 in 1879 and 8,915 in 1880; to Norfolk, 35 in 1879 and 26 in 1880; to Richmond, 21 in 1879 and 777 in 1880; to Virginia Midland RR., none in 1879 and 12 in 1880; to Southern States, 9,850 in 1879 and 9,390 in 1880.

The marked feature of this showing is the large increase in the traffic to northern cities, especially to Baltimore and Philadelphia, and in that to Lynchburg and Richmond. The increase in 1880, for the whole traffic, over 1879, was about 40 per cent.

Grace Furnace, of the Pa. & Va. Iron and Coal Co., at Ferrol, Augusta co., Va., on C. & O. Ry., of which Maj. J. F. Lewis is the general manager and Mr. C. A. Rundall the local manager, was in blast 101 days in 1880, during which it made 1,330 tons of pig iron. The average amount of coke used, per ton of iron made, was about 1.75 tons; of limestone 1.19; and of ore, from Ferrol mines, 2.21 tons. There were mined at the Ferrol mines, during the year 1880, of iron ore, 16,112 tons. Owing to the unusual severity of the weather, interfering with operations, this furnace was compelled to blow out before Christmas.

Lucy-Selina Furnace No. 2 of the Longdale Iron Co., was blown in, for the first time, Friday, Feb. 11th, 1881. This new furnace has worked well from the start and is now making about 33 tons per day; in our opinion it is a model, in all particulars, for a 50-ton furnace, and we shall try and give our readers, at an early day, the details of its construction, which was under the supervision of Mr. Harry Firmstone.

Monongahela Gas Coal Mine, at Wilsonburg, Harrison county, W. Va., is owned and operated by H. G. Davis & Co. It was opened in 1872 in the "9-ft. seam," which yields 8½ ft. of coal. Some 80 men are now worked and about 20,000 tons a year mined, most of which is used by the Baltimore & Ohio RR. This company owns here a large body of coal land.

Washington & Va. Mining Co. shipped, the latter part of 1880, from its mines at Madison Run, on Va. Midland RR., Orange Co., Va., 50 tons of brown hematite 50 per ct. ore to Baltimore, and 90 tons to Buffalo Gap furnace, Augusta Co., Va., a total of 140 tons. It began mining operations late in the year.

Harrison County Coal Co., Wm. H. Freeman Supt., near Clarksburg, Harrison county, W. Va., opened its mine in 1877, in the 9-ft. bituminous, gas coal bed of that region; it works about 40 hands and mines some 30,000 tons a year which is marketed along the Baltimore & Ohio RR. and to Chicago.

Slate.—A sample of slate has been taken from a stratum said to be 20 ft. thick, on the land of Dr. Joel Lewis, near Raleigh C. H., W. Va., says the "Index." It was planed and sawed and showed no grit. This is from the coal measures.

Oystering is a profitable business, judging from the statement of a Middlesex Co., Va., correspondent of the *Dispatch* who says that a very large proportion of the people of that county "make from $3 to $10 a day in open weather."

Gas coal for Richmond, Va., for the current year, will be furnished by Geo. Straughan of Coal Valley, Kanawha Co., W. Va., delivered in Richmond at $3.95 per ton, of which the collier gets 95 cts., and the C. & O. Railway $3.

Granite from quarries of Westham Granite Co. of Richmond Va., is to be used for the first story and for the "trimmings" of the new Chamber of Commerce building in Baltimore.

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COMMISSIONERS' SALE
OF THE
STAUNTON IRON WORKS,
STAUNTON, VA.

In pursuance of a decree of the Circuit Court of Augusta County, rendered on the 30th day of November, 1876, in the cause of "Menifee's adm'r vs. McMahon" therein pending, the undersigned special commissioners will proceed, on the premises in Staunton, Va., on

THURSDAY, the 24th DAY OF FEBRUARY, 1881,

to sell at public auction to the highest bidder, the real estate, machinery, patterns, flasks and stock on hand, &c., belonging to the Staunton Iron Works Co.

The real estate, a lot 130 ft.x160 ft., is situated on the corner of Lewis and Frederick streets, 4 blocks from the depot of C. & O. R'y Co., and has on it a 2-story machine and wood shop, 30x60 ft., 2-story office and pattern shop, 12x20 ft., foundry building 40x60 ft. with core oven 12x20 ft. in rear, storing building 20x40 ft., ample sheds, blacksmith shop, stable, &c., &c.

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One No. 2 shaper, which will plane 9½x18 in., &c., &c., &c.

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This sale is made for the purpose of winding up two estates.

The real estate, machinery, patterns, tools, &c., will be sold together—other personal property separately.

TERMS OF SALE:—Cash in hand to pay costs of suit and sale, and the balance, as to the personal property, on a credit of six months, and as to the realty, on credits of one, two, and three years, with interest, the purchaser to execute bonds with approved personal security for the deferred payments, and the title to be retained as ultimate security.

H. W. SHEFFEY,
H. M. BELL,
jan6-tds Commissioners.

POSTPONEMET.—The above sale is postponed until SATURDAY, APRIL 2d, 1881.

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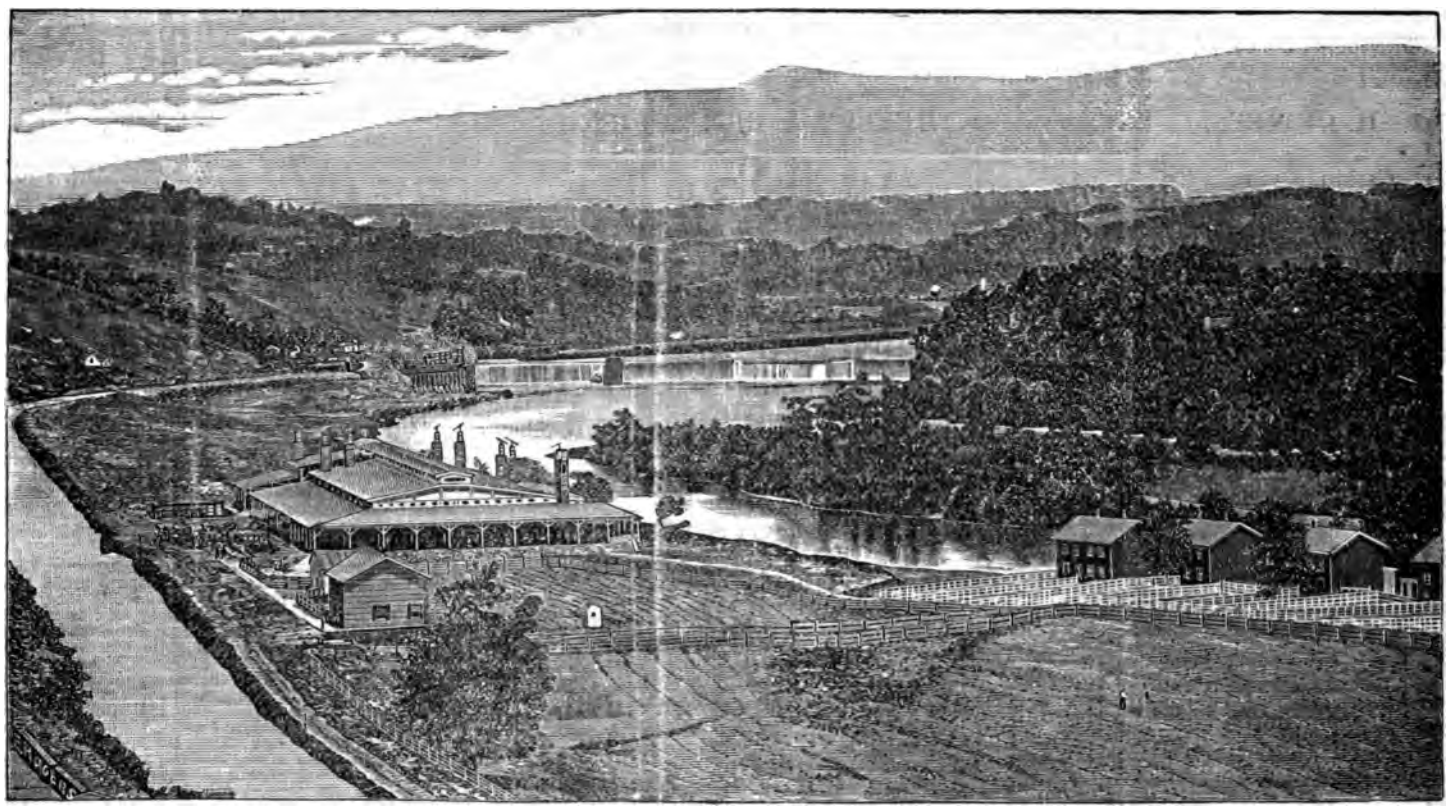

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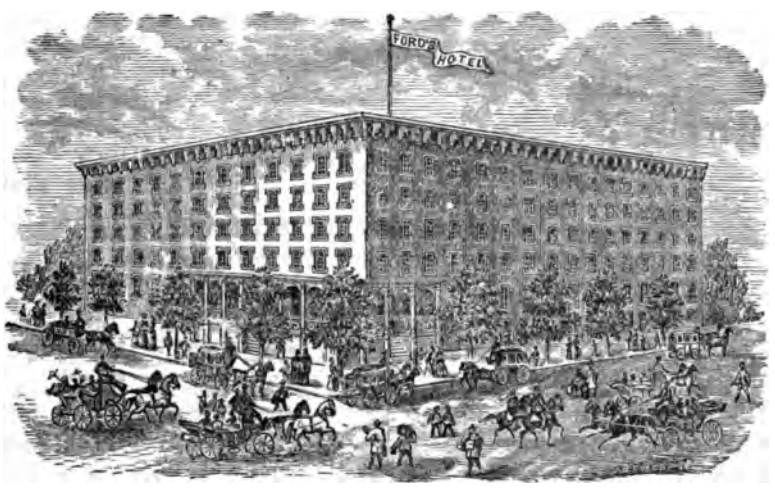

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Friday, May 13, 1881,

at 12 M., the real estate of Dr. Frederick J. Peters, known as "Sleepy Hollow" tract of land, about 3 miles below New Market, containing 1264½ acres. The said 1,264½ acres is a valuable mineral property, and is regarded by many as giving the strongest evidence of an unlimited quantity of iron ore, manganese, slate, marble and copper. About 300 acres is cleared and the remainder is in original growth. It lies within one mile of the R. & A. RR. with descending grade and right of way thereto. This property is looked upon as the most valuable mineral property that has ever been offered in this section of Virginia, and all persons desiring to purchase, are invited to examine. It will be sold either in whole or in part to suit bidders.

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FOR TERMS, apply to D. S. Forney, Allisonia, Pulaski Co., Va., or R. M. Lawson, Alexandria, Va.

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The undersigned, as President of a Land Company, has for sale or lease, on favorable terms, some of the best coal and timber lands in the New River District, on the line of the Chesapeake and Ohio Railway. The coals on these lands are the **Coking Coals**, the coke from which is now so much in demand for blast-furnace and other metallurgical uses. For further information and terms, apply to
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The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 3. } Staunton, Virginia, March, 1881. { Price 25 Cents.

The Virginias,

PUBLISHED MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor,

At 346 E. Main St., Staunton, Va.

Terms, including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising, per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors.), complete, with index and title page, will be sent, by express or mail, prepaid, to any address in the U. S., *on receipt of Three Dollars.*

Fred. P. Dewey, Chemist to Roane Iron Co., of Chattanooga, Tenn., offers his professional services in the making of analyses of ores, etc., through our advertising columns, and we commend him to our readers wanting such work done, especially to those in Southwest Virginia, as he is on the line of their great Norfolk and Western Railway and has peculiar facilities for communicating with them, and, besides, his regular work is the analysis and study of ores etc., from the mineral belts of the Southwest as extended into Tenn., giving additional value to his advice in reference to its minerals.—Prof. Dewey has already made numerous analyses of Virginia ores; some of zinc, made for Mr. D. S. Forney, of Allisonia, Pulaski Co., are given on page 34 of this issue, and he made a number of analyses of iron ores, for Maj. J. T. Hamlett, of Wytheville.

Shenandoah Valley RR. Co. had a meeting of its stockholders at Luray, Va., April 5th. Resolutions were adopted for a consolidation of the 1st and 2nd mortgage 7-per-cent bonds of the Co., now on the 143 miles of road, from Hagerstown, Md., to Waynesboro, Va., now in operation, and a new mortgage, in 6-per-cent bonds, for $25,000 a mile on the 236 miles of length the road will have when completed from Hagerstown to a junction with the Norfolk & Western probably at or near Big Lick, at a station most likely to be called Roanoke, as it will be near Roanoke river and in Roanoke county. Resolutions were also adopted looking to the immediate construction of the line southward from Waynesboro, keeping in the immediate vicinity of the western base of the Blue Ridge and near the outcrop of the great iron ore beds.

A settlement was made with the Shenandoah Valley Construction Co. and their work accepted. Hon. Wm. Milnes declined a re-election as president of the company, as all his time would be needed in connection with the contemplated improvements at the Shenandoah Iron Works; at the same time he nominated Mr. F. J. Kimball, the president of the S. V. Construction Co. for the position, and he was unanimously elected. The Construction Company, having executed the work for which it was organized, will now be dissolved and the work of extension will be done by the RR. Co. under the direction of its every way capable, energetic, and efficient president.

Mr. Milnes has unflinchingly labored for many years to secure the construction of this railway, and to him the region it traverses is largely indebted for the great thoroughfare that on the 15th of April will be opened for trade and travel from the heart of the Virginias to the northward.—The first train from Hagerstown to Waynesboro passed over the road Saturday, April 2nd.

The Virginias.—"The Journal is full of important information which I highly value."—Prof. Arnold Guyot, Princeton, N. J.

"There is hardly any of my scientific periodicals in which I am so much interested as in THE VIRGINIAS."—Prof. C. H. Hitchcock, of Dartmouth College, State Geologist of New Hampshire.

Correction.—On page 46 of this issue for *Bacony* falls put Balcony falls.

The Weather-Map of U. S., issued daily by the Signal Service, of which Gen. W. B. Hazen is Chief, has recently been much improved by having projected on it lines connecting all places having the same temperature (isotherms they are called) at the time of the issue of the map, and also lines showing the paths of the storm-centres and the rate of movement of those centres during the 24 hours preceding the issue of the map, in addition to the barometric lines (isobars they are called) that heretofore were the only ones projected on the map.—Now one can see, at a glance, the isotherms, the isobars, the storm-tracks and -centres, the condition of the face of the sky (whether clear or cloudy), the direction and velocity of the wind, whether it is raining or snowing, Fahrenheit degree of temperature, the height of the barometer, and the humidity of the atmosphere, at the same moment of actual time, that of 7 A. M. at Washington, over most of the United States and of British America south of 50 degrees N. latitude. Never before has there been such a daily presentation of the meteorology of so large a portion of the earth's surface. The "weather" can now be really observed to advantage and become an interesting topic of conversation.

Hileman, Waring & Co. are now the proprietors of Callie Furnace, Alleghany county, Va., the firm of Hileman, Cook & Co. having been dissolved, April 1, 1881, D. S. Cook and Harris Wilton retiring and selling their interests to J. B. Hileman, O. T. Waring, E. J. Waring and O. Hileman, who are the partners of the new firm of Hileman, Waring & Co. The address of the company is Williamson, Alleghany Co., Va.

Callie furnace is now in blast under the new management. Capt. D. S. Cook proposes to at once erect a large blast furnace on the Richmond & Alleghany RR., about 1.5 ms. S. E. of Callie furnace, on the "Reynolds" farm, which lies along the James and which he has purchased. A tramway, about 2 ms. long, will be made to his iron mines which adjoin those of Callie to the S. W. on Eastern Rich-patch mountain.

Norfolk and Western Railway.—Now that the sale of the Atlantic, Mississippi & Ohio RR. has been confirmed to a new corporation, to be known as the Norfolk & Western Ry. Co., which will take possession May 1st., we propose to accompany our next issue with a handsomely engraved map, showing the location and connections of that road and its Shenandoah Valley RR. mate—a combination of over 600 miles of Virginia railway—and their relations to the other railway systems and to the trade and travel of the United States. In the same number we shall set forth the relations this great railway system sustains in reference to the resources and development of Virginia,—a system that either crosses, traverses, or branches into, each of the seven grand divisions of her territory and is accessible from more of her area than any other of her railways.

Cotton in Va.—Col. A. Savage, in 1880, raised 2,000 lbs. of seed cotton, as an average, to the acre, on 28 acres of his farm 8 miles south of Norfolk. He says the staple raised in Tidewater Va. is as good as any shipped from N. C.; that 500 bales (500 lbs. each) were packed in his neighborhood last year, and that cotton is, with the exception of peanuts, the most profitable crop they raise, and that they compete in quantity per acre with the regular cotton states.—Dr. W. H. Daugherty, of Southampton county, says the average crop there is as good as in the cotton states where 500 lbs. of seed cotton is the average make per acre; on poor land, by the use of fertilizers, he makes 1,800 lbs. to the acre.—Letter to Dr. Pollard, Va. Com'r. of Agriculture.

Wanted, our readers that are owners of timber lands, and especially of mines of all kinds—iron ore, manganese, ochre, pyrites, copper, lead, zinc, chrome, coal, etc., etc.,—to know that we are daily in receipt of letters from all directions asking where such things can be had. If they will advertise these things in THE VIRGINIAS they will find purchasers, for it circulates among the buyers of such articles.—The owner of the zinc mine, that we advertise for sale, informs us that four letters of enquiry came by the same mail that brought him the number containing his advertisement from parties that had seen it in THE VIRGINIAS.

Bloomery Furnace Co., Hampshire county, W. Va., mined some 7,000 tons of "fossil ore" from its "Postley," "Open-cut" and "Minnesota" ore banks, during the 10th Census year, for use in its furnace, on Cacapon river which furnishes it 19 ft. of fall for a water-power.

Falling-Cliff Zinc.—The following analyses of the two representative ores of the Falling-Cliff Zinc mine, Wythe county, Va., were made by Prof. Fred. P. Dewey, chemist of Roane Iron Co., Chattanooga, Tenn.:—

	(1)	(2)
Silica	24.47	7.07
Sesquioxide of Iron	2.10	1.44
Alumina	1.24	0.66
Oxide of Manganese	0.16	0.11
Oxide of Zinc	61.84	61.99
Lime	0.53	0.16
Magnesia	0.21	0.21
Carbonic Acid	1.80	25.88
Water	8.27	2.58
	100.62	100.10
Metallic Zinc, per cent	49.63	49.75
Silver, by assay, per ton	1 oz.	1 oz.

(1) Is a Silicate of Zinc; and (2) is a Carbonate of Zinc.—In the refuse are barytes and zinc mechanically mixed, also iron and zinc, etc. In a previous assay the silver was found to be from 4.5 to 5.5 ounces per ton.

The Upper Freeport Coal paper, on page 28 of our Feb., 1881, number, by Prof. Stevenson, is completed by the following:—"This ore was mined at one time both by benching and drifting, and the material was sent to the Irontown furnace, where it produced a foundry iron. It is too cold-short for use alone, and to be available must be mixed with some ore containing little or no phosphorus. A small coal bed rests on the limestone, and another, about 2 ft. thick, is shown at nearly 70 ft. lower."

The Luray Cave & Hotel Co. was chartered Dec. 18, 1880, for the purpose of acquiring and holding the now famous Luray Cave and for building and conducting a hotel. The capital stock was fixed at $100,000, in $100 shares; the Co. may hold 1,000 acres of land. The officers for the first year are F. J. Kimball, president; Wm. G. Macdowell, secretary and treasurer. The other directors are U. L. Boyce, Jos. H. Shands, H. B. Tyler, Chas. Hucker, J. Ed. Roberts and Ro. H. Carson.

A Geological Reconnaissance of Parts of Lee, Wise, Scott and Washington Counties, Virginia.

By John J. Stevenson, Professor of Geology in the University of the City of New York. (With six wood cuts and a colored map.)

(Read before the American Philosophical Society, January 21, 1881.)

(Continued from Page 27.)

III. Geology of the Area Drained by Powell River.—The important coal-field lying north from Stone mountain narrows rapidly westward owing to the convergence of Stone and Black mountains, so that, as far as Virginia is concerned, it practically disappears at but a little way beyond Pennington gap. But the available area diminishes even more rapidly. The streams flowing from Black mountain become shorter, and have a greater fall, so that, as the beds dip towards Black mountain, the area above the natural drainage is much smaller even proportionately on the waters of the North Fork of Powell than it is along those forks which unite at the head of Big Stone gap.

The previous memoir by the writer contained a section of the *Coal Measures* as they appear above Big Stone gap; but the lower part was given according to a rude estimate, while 500 feet at the top had not been examined in detail. As already intimated, the unexamined part at the top is much greater than is given in that section. As amended, according to observations at the head of Pennington gap and according to Mr. Moore's barometric determination of the height of Black mountain at the head of Looney branch of Cumberland river, the section is:

1.	Not examined	800′
2.	Sandstone and sandy shale	200′
3.	Coal bed	0′ 4″
4.	Sandstone	30′
5.	Coal bed	1′ 5″
6.	Sandstone and shale	115′
7.	Coal bed	0′ 6″
8.	Sandstone	70′
9.	Coal bed	2′
10.	Fireclay with stigmaria	2′
11.	Sandstone	12′
12.	Coal bed	1′
13.	Sandstone	70′
14.	Shale	20′
15.	Coal bed	0′ 4″
16.	Sandstone	26′
17.	Shale	4′
18.	Coal bed	0′ 10″
19.	Ill-exposed, mostly sandstone	65′
20.	Coal bed "Cannel seam"	7′ 3″
21.	Sandstone	50′
22.	Coal bed—Upper splint	3′ 6″
23.	Sandstone	70′
24.	Coal bed—Lower splint	3′ 6″ to 4′ 6″
25.	Ill-exposed, mostly sandstone, some yellow shale	120′
26.	Coal bed	Blossom.
27.	Sandstone	70′
28.	Coal bed	1′
29.	Shale and sandstone	25′
30.	Coal bed—Kelly seam	2″ to 15′
31.	Sandstone	45′
32.	Shale	5′
33.	Coal bed—Imboden seam	8′
34.	Shale	6′
35.	Sandstone	35′
36.	Carbonaceous shale	0′ 4″
37.	Sandstone	70′
38.	Coal bed	1′ 6″
39.	Ill-exposed, mostly shale or shaly sandstone	60′
40.	Coal bed	1′ 6″ to 3′
41.	Sandstone	35′
42.	Coal bed	2′
43.	Sandstone	60′
44.	Coal bed	2′ to 3′
45.	Sandstone and some shale	80′
46.	Coal bed	3′
47.	Shale and sandstone	85′
48.	Coal bed, blossom seen, said to be	1′ 6″
49.	Interval concealed	125′
50.	Coal bed, not seen, said to be	2′
51.	Shale	25′
52.	"Bee rock" of Quinnimont group (No. XII.)	
	Total thickness	2,348′

As the important beds of this group were described in detail in the previous memoir, only a brief synopsis is necessary here. No additional information has been obtained respecting them, for the area drained through Pennington gap by the North Fork of Powell river is wholly undeveloped, and only the lower coal beds are well exposed.

The *Cannel* seam consists of:

Cannel	2′	7′ 3″
Alternating layer of coal and shale	1′ 10″	
Bituminous coal	3′ 5″	

But the bed is variable and at another locality it shows three layers of *coal*, amounting in all to but 2′, distributed through 19′ of measures. The *coal* from the *Upper splint* is of superior excellence, containing but 3.075 per cent of ash and but 0.406 of sulphur; the coal from the *Lower splint* seems to be of equally good quality. The *Kelly seam* is a variable bed, which, where thickest, shows three divisions; the upper one is slaty, the lower one is a splint of fair quality, while the middle division seems to be a gas coal of remarkable excellence, as it contains 38.850 of volatile combustible matter with 0.771 of sulphur and only 0.890 of ash.

The *Imboden* or *coking seam* is by far the most important. It was first traced by General J. D. Imboden, who made many prospecting pits in it to determine its value. This bed varies in thickness from 6′ 11″ to 8′ 5″, and everywhere yields a soft coal, which produces an excellent coke. The coal contains but 1.515 of ash and only 0.594 of sulphur.

Nos. 38 and 40 were seen only in Pennington gap. The former is insignificant; the latter is badly distorted by pressure and the coal is so crushed as to be useless. The whole section from No. 37 to the bottom is vertical at the head of Pennington gap. The coal bed, No. 42, has not been mined, but it is exposed in the bank of the North Fork, where it shows a clay parting midway. No. 46 is evidently the same with No. 44 of the section on p. 91 of the previous memoir. It shows nearly 8′ of good coal on the North Fork, where some mining has been done. The coal is fat, caking and contains much mineral charcoal. The two beds, Nos. 49 and 51, were reached only in Pennington gap, where they are no longer exposed.

Stone Mountain.—The structure of this mountain has been explained in another part of this memoir. The groups involved in the fold include the whole series from the Clinton up, but in the mountain as it now stands, one finds only the lower part of the Coal Measures, with the Quinnimont group and Lower Carboniferous. Exposures are very poor in both Little and Big Stone gaps, and the succession of the rocks could not be made out until Pennington gap was reached. There the following section of the Quinnimont group (XII) was obtained, the thickness being estimated;

		Feet.	Inches.
1.	Sandstone "Bee rock"	135	
2.	Shale	15	
3.	Sandstone	12	
4.	Coal bed . . . . . 1 ft. 2 in. to	3	
5.	Sandstone	20	
6.	Coal bed and shale	1	
7.	Sandstone	200	
8.	Conglomerate	100	
9.	Concealed	60	
10.	Sandstone	45	
11.	Coal bed	0	6
12.	Shale, clay and sandstone	40	
13.	Flaggy sandstone	15	
14.	Massive sandstone	120	
15.	Concealed	45	
16.	Coal bed with much shale	5	
17.	Imperfectly exposed, much conglomerate	95	
18.	Coal bed and shale	1	8
19.	Shale	20	
20.	Coal bed and shale	2	
21.	Clay	7	
22.	Sandstone	15	
23.	Pockets of coal in sandstone	7	
24.	Conglomerate	45	
	Total	1,009	2

The rocks are vertical; but the gorge is very crooked and some difficulty was encountered in the effort to estimate the thickness of No. 7, which may be somewhat greater than is given above.

No. 1, the "Bee rock" of Big Stone gap, forms a conspicuous comb along Stone mountain from Little Stone gap to certainly 3 miles west from Pennington gap, and it is well shown at the head of each gap. The upper part is flaggy and rather fine-grained; but below the rock becomes massive and coarser, with numerous pebbles. No bedding is perceptible for 65 feet from the bottom. Some plant impressions were seen and there is much carbonized wood in large fragments. The shales underlying this rock are brown to reddish brown, clayey and without distinct bedding. The sandstone, No. 3, is blue and flaggy in the upper part, but becomes gray and shaly below.

The *Coal bed*, No. 4, is much crushed and its thickness has been much reduced by violent pressure. It is badly twisted and is from 14″ to 3′ thick. The coal is good, caking, admirable for blacksmiths' use and contains much mineral charcoal. The underlying sandstone is argillaceous and near the coal it is really a sandy fire-clay containing many stems and rootlets of *Stigmaria*. The little *Coal bed*, No. 6, is but 5″ thick and has black shale both above and below it.

No full exposure of the sandstone, No. 7, could be found. The mass varies from fine-grained sandstone to coarse conglomerate and holds some bands of shale. A *Coal bed* is said to occur in this interval, but no traces of it were seen. Nos. 8 and 10 are conglomerate. The latter crosses the river at Pennington's mill and is well exposed immediately below the dam. It is light gray, cross-bedded and contains many rude impressions of plant stems. Some of its finer layers yield a good firestone; and the lining of Pennington's forge, constructed of this sandstone, has stood for three years. This is said to bear a dash of cold water without cracking, even when at a bright red heat. The little *Coal bed*, No. 11, is of no value, but the clay underneath it makes excellent brick though it is too ferruginous to be used for fire-brick. No. 13 is shown immediately below the forge and some of its layers do well as firestone. Much coarse conglomerate occurs in Nos. 14 and 17, and there are several coarse layers in No. 24. Many impressions of plant stems were seen in No. 22.

The *Coal beds*, Nos. 16, 18 and 20, are no longer exposed in the gap. They were opened by Mr. Pennington, but proved worthless. No. 16 was opened both in the bank of the stream and on the hillside; it is 5′ thick at both places, but the *coal* and shale are in nearly equal proportion and are so mixed that the bed is without value. A bed, shown on the ridge at about 2 and a half miles from the gap, is supposed by Mr. Pennington to be the same with No. 16. It is 2′ 9″ thick and yields good coal, of which some has been hauled to Jonesville.

The other beds consist only of a worthless commingling of *coal* and shale. No. 23 may have been a *Coal bed* at one time, but if so, it was torn up and re-distributed during the formation of the overlying sandstone, for now it consists of simply small pockets of pulverized coal scattered through 7′ of sandstone.

The massive beds of this group project above the surface like dikes and some of them overhang the river.

The Lower Carboniferous limestone is well exposed at many places along Stone mountain, but continuous exposures were found only in Pennington gap, where the following succession was made out, the thicknesses being estimated:

Mountain Limestone group.

		Feet.
1.	Imperfectly exposed	40
2.	Sandstone	15
3.	Dark fissile shale	5
4.	Sandstone	20
5.	Imperfectly exposed, much shale	200
6.	Sandstone	75
7.	Shale with thin limestone	35
8.	Sandstone	40
9.	Concealed	60
10.	Calcareous sandstone	120
11.	Dark fissile shale	5
12.	Calcareous shale	90
13.	Argillaceous limestone, fossiliferous	15
14.	Imperfectly exposed	60
15.	Massive limestone	25
16.	Calcareous shale, fossiliferous	50
	Total	855

Silicious group.

17.	Limestone	200
18.	Shale and sandstone	150
	Total	350

The interval, No. 1, is filled for the most part with shale, though there are traces of sandstone and a bed of rather lean carbonate of iron. The latter has been opened by Mr. Pennington, but it is too lean for use in his forge. The shale, No. 3, is quite rich in carbonaceous matter and it may represent the *Coal beds* of southwest Pennsylvania, belonging at this horizon. Nos. 2 and 4 are hard red grits. The interval, No. 5, contains some red shale, and some bluish grit-like beds, but for the most part it is effectually concealed. The sandstone, No. 6, is fine-grained, mostly light colored, and the sand is sharp and clean. The bed is well exposed on both sides of Pennington gap and is the first sandstone bed seen in ascending Big Stone gap. It is the principal source of the sand covering the "bottom" of Powell river and that of the North Fork near the gaps. No. 10 is a hard blue grit, containing not a

little oxide of iron, which causes disintegration on exposure. It is well shown in the bed of the North Fork in Pennington gap. No. 14 is imperfectly exposed, but here and there it shows some limestone and red shale. Mr. Pennington says that some good iron ore has been obtained from this interval. No. 15 is an excellent limestone, and it would be good either for furnace use or in the manufacture of lime. Chert first appears in the lower part of No. 16, where numerous layers were seen from half an inch to two inches thick and richly fossiliferous. From one of these the following species were obtained during a hurried examination: *Fenestella; Zaphrentis Spinulifera; Productus semi-reticulatus; Hemipronites crassus; Spirifera leidyi;* and *Athyris subquadrata.*

The great limestone, No 17, is well shown along the southerly face of Stone mountain from Little Stone gap to far beyond Pennington gap; and it is well exposed in each of the gaps. The rock is mostly fine-grained and compact, with conchoidal fracture, though here and there a layer occurs which is somewhat granular. Some beds contain much chert in nodules occasionally as large as an orange. Fossils are numerous, but for the most part they cannot be obtained in identifiable condition. *Productus cora* with an unrecognized *Zaphrentis* were obtained near the mouth of Big Stone gap.

No. 18 has been identified by Mr. Moore with the Protean member of the Silicious group of Tennessee, the Knobstone of the old Kentucky reports. It is not very well exposed at any locality visited; but as far as seen, it consists of bluish sandstones, weathering reddish, with some shale. These sandstones are slightly calcareous and some of them are true grits. No fossils were seen in this stratum.

Poor Valley and Poor Valley Ridge.—Under this head may be included not only that narrow area between Stone mountain and the fault of Poor Valley ridge, but also the area around the headwaters of the South Fork of Powell river and its tributary, Wildcat creek. This embraces so much of the region between Stone mountain and Powell mountain as is drained by those streams.

At the apex of this space, where Stone and Powell mountains come together, just east from Little Stone gap, one finds in the valley only the Hamilton shales. The gentle anticlinal, in which the fault of Poor Valley ridge originates, soon brings up the Oriskany, the Lower Helderberg, and, at a little way further west, the Clinton ore group. The ridge formed by the anticlinal and gradually developing fault is known here as Wallen ridge and shows the Clinton group on both sides, with the higher groups at a little distance from the foot. No detailed section was made on Powell mountain, but the Hamilton shales are at its base; higher up is the Lower Carboniferous, forming a conspicuous band along the face of the mountain; while above it the Quinnimont group extends to the crest, whence it may be followed to the Hunter valley.

Along Wildcat valley and the southerly slope of Wallen ridge, Upper Silurian rocks prevail, the Medina at the crest of the ridge, the Clinton lower down the slope, while the Lower Helderberg occupies the valley and here and there reaches some way up the side of the ridge. The Clinton ores are unusually good here, that from one bed showing 52.6 per cent of iron with but 0.116 per cent of phosphorus.* The Lower Helderberg shows two ore-horizons, of which the upper may belong in part to the Oriskany. The lower horizon has an unusually good brown hematite, with 52.55 per cent of iron and only 0.051 per cent of phosphorus. The pockets of good ore are separated by stretches of varying length, in which an enormous amount of brown hematite is seen, but so mixed with sand as to be altogether unavailable. Beyond all doubt the higher horizon carries much good ore, but the old workings, whence ore was obtained for a Catalan forge, have been filled up and only the silicious ore is exposed.

The Helderberg ores of Poor valley are of uncertain value. Some fair ore occurs at several miles east from Big Stone gap, but the most of that seen there is silicious and evidently belongs to the higher horizon. It contains many fossils characteristic of the Lower Helderberg. Further west the ore seems to be wanting, no evidence of its presence having been observed at any exposure between Big Stone and Pennington gaps.

*All analyses in this memoir, unless otherwise stated, are by Mr. A. S. McCreath, chemist to the Second Geological Survey of Pennsylvania.

The best exposure of the Hamilton shales in the Poor valley is at a mile or so east from Big Stone gap, where the rock seems to be thicker than it is further west. It is said to yield fossils there. The increasing strength of the disturbance westward makes the dip of these beds vertical before reaching Pennington gap and the exposures in that vicinity are not wholly satisfactory. The valley itself is very narrow until beyond that gap, where it opens up somewhat. No traces of Chemung rocks were found in the valley and the Lower Carboniferous rests directly on the lower black shales of the Hamilton.

No good section of the Clinton was obtained and the partial one obtained near Big Stone gap and given in the previous memoir contains all the details yet secured. The ores of this group are easily followed along the valley and ridge. Three beds occur not far from Big Stone gap, but only one of them is really important. This, as exposed on the Horton property at say a mile and a half from the gap, shows:

	Ft.	In.
Hard ore	4	8
Soft ore	2	6

The lower part of the upper layer for, say 20″, is a very fair ore, though inferior to that from the lower portion of the bed. This is the middle bed. The upper bed is shown in the bank of Powell river not far from the gap, where it is from 5″ to 8″ thick; while the lower bed, as shown in Cedar gap, through Poor Valley ridge, contains little soft ore. The same beds are shown in the gap of Powell river through Poor Valley ridge and some of the ore from that locality has been reduced in Mr. Pennington's forge, where it proved good. Mr. Pennington has opened three beds of ore near his gap, but of these only the middle one is good. This shows:

	Inches.
Soft ore	4
Clay	8
Soft ore	25

The clay is irregular and is said to disappear, so that the ore is sometimes fully 3′ thick. The upper layer at this exposure is pebbly and the lower layer is equally so for an inch or two at the top; but Mr. Pennington states that this is an abnormal condition and that the pebbles are rarely present. This ore is mined to supply Pennington's forge at which about 200 pounds of excellent iron are made daily.

Powell Valley.—Throughout this valley, which embraces the whole space between Poor Valley ridge and Wallen ridge, one finds only formations II and III. The distinction between the groups was not made out in detail, for the structure is too involved to be worked in a reconnaissance. It is altogether probable that the magnesian beds of the Knox group occupy the northern side of the valley in the wider parts of the area. They lie close to the fault in the Turkey cove, while, nearer Wallen ridge, the beds of the higher group are well shown and yield great numbers of characteristic fossils. Good localities for collectors were seen along the road crossing Wallen ridge from Turkey cove, and along the Jonesville and Gladesville road in the cove. The magnesian limestones on Elk knob are practically horizontal and weather into detached blocks and pillars, making the long summit of that hill a "rock city." Brown hematite of excellent quality is said to exist on Chestnut ridge in this valley; and some of it has been tried with good results at Pennington's forge.

Wallen Ridge and Valley.—At Turkey cove, the limestones of III rise high up on the side of Wallen ridge, but the shales belonging at the top of the group are concealed along the road crossing the ridge. Further west, however, as the ridge is pushed away toward the south-east, the limestones reach only to its foot or to but a little way up its side. The shales are well shown along the Jonesville and Estillville road as it winds up the mountain. They are dark and fissile below but become somewhat sandy above. Thin irregular bands of limestone occur, all of which are fossiliferous. The thickness of the shales is not far from 700 feet.

The Medina sandstone is reached at the summit of the ridge, where, for the most part, it is fine grained and compact; but it contains some layers of shale and an occasional bed of conglomerate. Exposures are incomplete near the road, but the rock forms cliffs at two or three miles further east. The thick-

ness, as estimated, is not far from 350 feet. The Clinton group is reached on the southerly side, where it is not well exposed. The fossil ores are shown at several places, but are best seen near the head of the valley, where Mr. Jerome Duff has explored them to a slight extent. The Lower Helderberg rocks are mostly concealed.

The Wallen valley fault passes very near the southerly foot of Wallen ridge, and is crossed by the Jonesville road at perhaps three-fourths of a mile from Wallen creek. The exposures near the line of fault are very poor, but they suffice to show that the beds in contact with those of the Lower Helderberg belong near the top of the Knox group, for the soil has a deep red color and fragments of chert are scattered through it. The first satisfactory exposures are those of the Trenton and Nashville group, whose beds are well shown at Stickleyville and elsewhere along Wallen creek. They are very fossiliferous, though the number of species found at Stickleyville is small. The following were seen.

Stromatopora; Chætetes petropolitana; Bryozoans; Strophomena alternata; Leptæna sericea; Orthis testudinaria; Orthis occidentalis; Orthis tricenaria?. The *Chætetes* is often replaced by chert, as is also the case on the northerly side of Elk knob in Powell valley.

The limestones of this group continue nearly half way up Powell mountain, and thence to the summit, the shales of the group are occasionally shown. The Medina sandstone is reached at the summit, where one looks down into the area drained by Clinch river.

As the Wallen Valley fault disappears north-eastward, the outcroppings of Upper Silurian on the southerly slopes of Wallen ridge and Powell mountain approach each other; and on the easterly face of the divide between Wallen creek and the North Fork of Clinch, the two outcrops seem to have come together, as do the similar outcrops on Wallen and Poor Valley ridges where the fault of the latter dies out. No detailed examination of this divide was made, and the structure was ascertained only in so far as was possible in passing through Slemp gap.

IV. Geology of the Area Drained by Clinch River.—The whole of this area lies within Scott county. For convenience of description, it may be regarded as divided by the road leading from Big Stone gap to the mouth of Stock creek. The easterly division extends from the crest of Powell mountain to that of Moccasin ridge, and is drained by several streams, to which reference will be made in their place; the other division extends westwardly to the Tennessee line and southwardly from the crest of Powell mountain to Clinch river. It is drained principally by Little Stock creek and the North Fork of Clinch river.

The Western Division.—The Medina sandstone is somewhat imperfectly exposed on the summit of Powell mountain along the Jonesville and Estillville road, but appears in cliffs at but a little way further east. Its junction with the shales of formation III is well shown at the roadside, and is very sharp, there being no transition bed. The Medina, for 35′ from the base, is massive, cross-bedded, and not at all conglomerate, though here and there a pebble appears. Impressions of *Arthrophycus*, though not abundant, are by no means rare. Some imperfect exposures of Clinton rocks were seen at about one-third of the way down the mountain slope and numerous fragments of fossiliferous ore lie scattered in the road and on the hillside. Only one bed, however, was found in place, and its ore is highly silicious. Further east along this slope of the mountain, three beds have been exposed on the property lately belonging in the Kane estate, which are equivalent to the three beds seen in the Poor Valley ridge. The upper one is very thin, and its ore is silicious, but the middle and lower beds are of workable thickness and their ore is good, though evidently somewhat leaner than that from the middle bed of the Poor Valley ridge.

These ores extend along the mountain face quite to the head of the North Fork of Clinch river, whence they cross the divide and continue along the southerly face of Wallen ridge along Wildcat valley; but no measurement of the group or of its ores was made in Slemp gap or above it along the North Fork of Clinch.

Still further down the slope or very near the foot of the mountain are the Lower Helderberg and the Oriskany, beyond which come the shales of the Hamilton. A small tributary to the North Fork of Clinch flows along the foot of the mountain, and the road to Sneedsville follows it. These rocks are exposed along this stream, and the shales are reached at Robinson's mill, where they are dipping almost southward at a high angle. At a little way below the mill, the stream enters a gap through a low ridge produced by the Pattonsville fault, and on the other side it joins the North Fork. At the entrance to the gap, one reaches the coarse sandstone, and the limestone at the base of the Lower Helderberg, both of which have been pushed to 5° beyond perpendicular. Several exposures of Lower Helderberg rocks occur within this gap, but the section is not continuous.

On emerging from the gap made through this low ridge, the stream enters the North Fork, which there changes its course, and for a short distance flows irregularly along the strike. The road follows the right bank of the stream, and winds so as to be now in the Lower Helderberg, then in the Hamilton shales. The upper limestone of the Lower Helderberg is well exposed at the roadside, not far below the gap, where it underlies the Oriskany, which is ferriferous. The river changes its course near Mr. James Robinet's place, and breaks across the Hunter Valley fault (Clinch River uplift), whose course is marked by Buckner ridge. The Hamilton shales are fairly well exposed here and are dark throughout. Those resting on the Oriskany are richly carbonaceous, and films of *coal* are common in one layer, which is nearly 18″ thick.

No rocks newer than the Hamilton shales are shown between the crest of Powell mountain and Buckner ridge, as far, at least, as two miles west from the North Fork gap in the latter ridge. If the Pattonsville fault were absent, there would be ample room for the Lower Carboniferous groups, which, indeed, are present on Powell mountain in the other division of this area. A material change in the character of this fault must take place at not far from the gap, for Prof. Safford's map shows that the Lower Carboniferous groups are present at the State line both on the slope of Powell mountain, and on the ridge marked by the Pattonsville fault.

The gap of North Fork of Clinch exhibits the complicated structure of the Hunter Valley fault or Clinch River uplift. The pyritous calcareous sandstones, belonging to the base of the Knox group, form a bold ridge with the rocks dipping southward at almost 50°; but at the base of the cliff on the northerly side a considerable mass of limestones, reddish and white sandstones was seen. This is not less than 150 feet thick. Behind it is an imperfectly exposed interval between the base of this bluff, and the last exposure of Hamilton shale, in which are fragments of sandstone not unlike the Oriskany. This mass is covered with débris and the succession of its beds could not be made out. Unsuccessful search was made for fossils. A conglomerate of rounded quartz pebbles bounded by red hematite occurs here, and bears much resemblance to the Clinton ore; with it is a ferruginous sandstone, which, when casually examined appears to be an iron ore. It is, however, merely a very fine-grained ferruginous sandstone. This is shown on both sides of the gap, and the apparent amount of ore is very great. But the material is utterly worthless as appears from Mr. McCreath's analyses; No. 1 being the conglomerate, and No. 2 the ferruginous sandstone.

	(1)	(2)
Metallic iron	12.050	11.550
Sulphur	0.052	——
Phosphorus	0.862	——
Insoluble residue	69.400	——

This was worked many years ago in a forge, whose ruins still remain in the gap.

Returning now to the Jonesville and Estillville road, one finds the Lower Helderberg, Oriskany and Hamilton as at Robinson's mill on the Sneedsville road, and the little village of Pattonsville stands on the Hamilton; but the Pattonsville fault is crossed by that road immediately beyond the village and the Lower Helderberg is brought up as in the gap below Robinson's mill. The Oriskany sandstone is reached again near the "bottom" of North Fork of Clinch and varies in color from rusty yellow to dingy white. The rock is very friable and it must be somewhat calcareous, as the surface has given away at many places, showing the presence of caverns beneath. The

hills are covered with loose reddish yellow sand, derived from this rock. Both the Lower Helderberg and the Oriskany sandstones are fossiliferous but the fossils are very obscure. Brown hematite occurs on the Pattonsville ridge and is continuous up the North Fork of Clinch. No analyses of this ore have been made, but the quality seems to be good. The Hamilton shales are continuous to the wall of Powell mountain in the other division of this area and are fairly well exposed at many places. Here, as at many other localities, they are supposed to hold *coal.*

Ascending the North Fork one reaches the strip of Lower Helderberg rocks in Slemp gap near Ward's mill, and the upper limestone of that group is well shown at but a little way above the mill. These rocks remain in sight on both sides of the road until the summit between Clinch and Powell is reached. The Oriskany was not seen here, its place being concealed.

Returning again to the Jonesville and Estillville road, one crosses the Hunter Valley fault and enters Buckner ridge at probably 2 miles from Pattonsville. An ill-exposed space of about 10 yards exists here, but there seems to be no reason to suppose that any rock lower than the Hamilton shale is here brought to the surface. The Robinet "ores" are clearly absent.

In Buckner ridge the calcareous sandstones and silicious limestones at the base of the Knox group have a dip of 45°, which soon decreases to 30°. With these are thin beds of shale, and the whole thickness is not far from 500 feet. Above this series are shales with irregular beds of impure limestone, in all about 1,000 feet thick. These are followed by massive limestone, some of it dolomite, which extends beyond the divide and appears on the waters of Little Stock creek. The exposures are indistinct beyond this divide, until at some distance one comes to shales which bear close resemblance to those which rest on the calcareous sandstones. These shales are well shown along Little Stock creek, which flows between them and the massive magnesian limestones. The shales are badly twisted. The creek flows through a tunnel in the limestone, which is not far from 600 feet long, and from 10 to 15 feet high.

Few observations were made in Big ridge, the continuation of Copper ridge beyond Clinch river. The rocks are the same as those seen in Copper ridge and it is altogether probable that the reports respecting the occurrence of iron and manganese ores are true. One may not do more than to assert the mere occurrence of these ores, as nothing has been done to determine the extent of the deposits.

The Eastern Division.—The gradual disappearance eastward of the Pattonsville and Wallen Valley faults has permitted the retention of much newer rocks on the eastern than on the western part of Powell mountain; so that on the former the Quinnimont group and not the Medina sandstone forms the crest of the ridge.

Powell mountain has an abrupt slope on the northwesterly side, and the face toward Slemp gap is so steep that it can be climbed only with great difficulty. The succession of the rocks on these bluffs is distinct, the Quinnimont group forming the rim, with Lower Carboniferous, the Devonian and the higher beds of the Silurian in order below it. No detailed section was made here, but the Chemung, if present, must be extremely thin, and the probabilities are altogether in favor of the conclusion that it is wholly wanting.

The Hamilton shales are well shown on the road following the foot of Powell mountain and they contain carbonaceous bands in which thin streaks of *coal* occasionally occur. One of these was seen at barely half a mile below Ward's mill. The Lower Carboniferous rocks make a well-defined band, curving round the end of the ridge in Slemp gap and continuing to immediately beyond Powder Mill gap, terminating where the Hunter Valley road leaves the line of railroad. The Mountain Limestone group is exposed near the school-house not far from the railroad, where it contains *Pentremites godonii*, *Zaphrentis*, *Productus semi-reticulatus* and *Chonetes.* The Hamilton shale is shown between it and the calcareous sandstone of the Knox group, turned up by the Hunter Valley fault or Clinch river uplift. No traces of any lower rocks were observed between the limestone and the line of fault.

The rocks of the Knox group forms a sharp, though low ridge, which is continuous into Russell county. The Hunter Valley road lies behind the ridge and soon rises upon the Quinnimont rocks, which seem to be in contact with the beds on the opposite side of the fault. This, probably is not the case, but the coat of débris between the last definite exposures of the conglomerate and the base of the sandstone wall is so thick as to conceal everything.

Coal blossoms have been seen in all the hollows leading from the northern side of Hunter valley into Powell mountain. Some *coal* has been obtained along the Laurel Fork of Stock creek, at probably two-thirds of a mile from the valley, but the gorge is so close and rugged, that the coal can be brought down only by packing it on men's shoulders. In a bed which has been opened along the main stream at only a few yards from the road, the coal is decidedly good, being preferred to all others by blacksmiths; but the bed is badly distorted and crushed. It stands at an angle of 45° and varies in thickness from 2 inches to 14 inches within a distance of two or three feet. The sharp dip prevails to nearly a half mile from the valley, where it changes suddenly and becomes not more than 5° or 6°. At say a mile from the road, Mr. Horton has opened a bed on Stock creek, where the exposure is:

	Ft.	In.
Sandstone	20	
Shale	5	
Coal bed	2 to 3	
Clay seen	0	8

The roof is very insecure, the shale being slickensided in nests, and a serious fall was seen at 30 feet from the mouth of the pit. The coal is regular, shows no signs of crushing such as those observed in the higher bed and is an excellent fuel for domestic use. It contains a good deal of pyrites and blacksmiths complain that they need much borax when using this coal. Not a little mining has been done here and some of the coal has been carried to Estillville, nearly 20 miles away.

The higher bed is evidently the same with that seen in Pennington gap under the "Bee Rock." Its characteristics and those of the rock above and below it are the same with those observed in that gap. The lower bed is not shown in the gap and it must belong somewhere in the ill-exposed interval, No. 7 of that section, as bold cliffs of conglomerate were seen below it. The interval between the two beds cannot be determined without careful instrumental measurement.

The upper bed has been opened by Mr. H. Stone at about a mile further up Hunter valley. His pit has fallen in and the bed is concealed, but its features as described by Mr. Stone are similar to those observed at Mr. Bailey's pit. Coal blossoms occur at several places on Cove creek, a tributary to Clinch river flowing from the valley across the fault, but no attempt has been made to ascertain either the thickness or the quality of the coal. Mr. Pinckney Carter has opened two beds on Stony creek. The upper of these is in all probability the same with that opened by Mr. Bailey and Mr. Stone, and it is exposed on Stony creek at somewhat less than one-fourth of a mile above Mr. Carter's house. It resembles a pocket rather than a bed and dips at somewhat more than 30°. The opening extends along the face of the cliff for about 35 feet; the *coal* is three feet thick at the thickest place but pinches out on each side to nothing. More than 10,000 bushels of coal are said to have been taken from this clumsy pit and packed down a rocky trail by the diggers. The *coal* is excellent for blacksmiths' use. Another bed, probably 300 feet further up the stream calculating in the direction of the dip, is 2 feet thick. A third bed, also about 2 feet thick, which is shown at say one-fourth of a mile up the left hand fork of the creek, has but an insignificant dip. The several openings seen along this stream probably belong to this bed.

Clay iron-stone occurs in moderate quantity in the shaly beds of the Quinnimont group, but there is not enough to be of economical importance.

The peculiar structure of the Hunter Valley fault in the vicinity of Stony creek has been explained in another part of this memoir. The fault appears to be simple until within less than two miles of that creek, and the only rock shown at the base of the Knox wall is some Hamilton shale. But at Mr. Boatwright's place on Stony creek, the Lower Carboniferous, Hamilton, Oriskany, Lower Helderberg and Clinton were all recognized between the Conglomerate and the Knox group. These seem to come in reversed order as already explained.

The exposure on Mr. Boatwright's property is good. Two beds of the Clinton ore were seen there, which represent the upper and middle beds of the Poor Valley ridge. The upper bed is silicious and no special investigation of it was made. The other was exposed to a thickness of 2 feet for examination and it is said to be 6 feet thick in an excavation now filled up. But this thickness is doubtless an exaggeration, and the excavation may have followed

the dip, which is abrupt. *Leptocœlia hemispherica* was recognized in this bed. The ore analyzed by Mr. McCreath yielded:

Metallic iron	43.650
Sulphur	0.008
Phosphorus	0.101
Insoluble residue	31.480

The Lower Helderberg brown hematite is exposed at several localities here on both sides of Stony Creek valley. Samples of the ore analyzed by Mr. McCreath showed:

Metallic iron	41.875
Sulphur	0.060
Phosphorus	0.890
Insoluble residue	22.200

But is clear that the samples from this bed are not altogether fair, as the yield in a forge seems to have been greater than the amount of iron shown by analysis. This ore was digged to some extent for use at the forge on Moccasin creek near Estillville; but the diggings were abandoned many years ago and the samples were taken from loose pieces which had been weathering for probably 20 years. The limestone of the Lower Helderberg is very fossiliferous and its species ally it closely to the Delthyris Shaly Limestone of the New York group. The Oriskany sandstone is well shown and contains *Streptorhynchus hipparionyx*.

There is little of interest between the Hunter Valley fault and Clinch river. In descending Stock creek, one finds himself constantly in the shales and limestones, of the Knox group and the dip is not rapid until near the river. The creek flows through a great tunnel in magnesian limestone. The limestone is so magnesian that the inhabitants of the neighborhood use it as a purgative instead of epsom salts. Midway in the cliff, which overhangs the mouth of the tunnel, is the entrance to a great cave which reaches to within 65 feet of the summit of the hill. The tunnel is 500 feet long, 25 feet high and 35 feet wide. The surveyed line of the Bristol Narrow Gauge Railroad passes through it.—This is known as the Natural tunnel.

The elevated area known as Rye cove is but a little way east from Stock creek. There the dip of the limestones is gentle and the projecting rocks interfere materially with agricultural operations. Between the mouth of Stony creek and Gray's ford, four miles further up Clinch river, the rocks show that they have described a fold. Along Stony creek, the calcareous sandstones at the base of the Knox group are shown succeeded by shales, as near the North Fork of Clinch; above these are massive magnesian limestones containing much oxide of iron and covered with a red soil. But, as in so many other localities, the limestones are so poorly exposed that the structure cannot be made out. Near the river, the shales are shown again and are vertical, giving evidence of having been subjected to enormous pressure.

Copper ridge lies between Clinch river and Copper creek. It consists of three narrow ridges formed by the branches of streams, which flow longitudinally through it. The low divides occasionally render this subdivision obscure, but such obscurity is usually of short continuance. The rocks belong to the Knox and the Trenton and Nashville groups of Safford. The subdivision into ridges is mainly due to the thick cherty beds of the Knox group.

A pyritous calcareous sandstone, holding some limestones, is shown at the foot of the ridge along Clinch river. It bears close resemblance to the calcareous sandstone at the base of the Knox group, so close, indeed, that the writer at one time believed that it was the same and that its presence is due to a fault. But it is not succeeded by shales such as are shown near the Hunter Valley fault.

The dip is abrupt near Clinch river, but becomes gentler, within the ridge, only to become abrupt once more toward the southerly side of the ridge.

The cherty rocks of the Knox group carry brown hematites and oxide of manganese, of which fragments occur plentifully along the crests of the minor ridges. Openings have been made at several places to supply ore to White's forge on Moccasin creek; but these have been abandoned for a long time and only fragments of the ore could be found. The manganese at some localities is decidedly good, as appears from Mr. McCreath's analysis of samples from the Salling property, which is as follows:

Metallic manganese	51.495
Metallic iron	0.567
Sulphur	0.000
Phosphorus	0.027
Insoluble residue	8.080

This ore contains 10.141 per cent of baryta. The percentage of binoxide of manganese is 81.455.

V. Area Drained by the Holston River.—No examinations were made in this area west from the Estillville and Reedy creek road.

The rocks of Moccasin ridge belong wholly to the Knox and the Trenton and Nashville groups, but the higher beds of the latter group are reached only on the northerly side of Clinch mountain. Very good exposures of that group and of the upper part of the Knox group can be obtained in passing from Clinch mountain through Estillville and thence toward Copper creek, by either the Rye Cove or the Stony Creek road. The higher beds of the following section were seen on the former road, while the lower beds were examined on the latter. There may be an error in No. 15, for that is the horizon at which the two sections were joined, and the thickness of that mass may be greater than is given. All thicknesses are based on estimates, the dip being such that instrumental measurement is necessary for accurate determinations.

Trenton and Nashville Group.

	Ft.
1. Shale and thin limestone	600
2. Limestone and calcareous shale	25
3. Calcareous shale	150
4. Limestone	70
5. Shale	65
6. Limestone	45
7. Shale	50
8. Massive limestones	200
Total	1,165

Knox Group.

9. Cherty rock and limestone	180
10. Limestone and shale	150
11. Concealed	60
12. Cherty rock	165
13. Light blue limestone	55
14. Concealed	15
15. Limestone, shale and chert beds	300
16. Variegated shale	70
17. Limestone	250
18. Shale	60
19. Limestone	200
20. Shale	80
21. Silicious limestone	200
Total Knox group exposed,	1,765

No. 21 is exposed along Copper creek, and is the rock which, in this memoir, has been regarded as marking the base of the upper division of the Knox group. The dip throughout Moccasin ridge is not far from 30°, but the rate increases on Clinch mountain, that at the base of No. 3 being 42°.

No continuous exposure of the shales, No. 1, was seen; but, as far as observed here, the features are the same as on the northerly side of Wallen ridge. Thin limestones were seen, several of which are fossiliferous. No. 2 is well shown on the side of Clinch mountain at the residence of Mr. R. A. Ayres, opposite the village of Estillville, where it consists of limestone, 2 ft.; calcareous shale, 10 ft.; ferruginous shale, 5 ft.; limestone, 8 ft. The upper limestone is impure, irregularly bedded, and contains a few fossils; the lower limestone is light gray, weathers blue, is richly fossiliferous, and contains some pyrites. No. 3 is shown at the same locality, and also along the road from Estillville to Moccasin gap. It consists of red and brown shales on Mr. Ayres' property, more or less calcareous, with some beds of limestone, which become more important at the exposures near Moccasin creek. No. 4, as exposed along the road to Mr. Ayres' house, is an almost continuous mass of limestone, much of it in thick beds, and some parts of it fossiliferous. Several of the thicker layers are streaked with white calc-spar. The color varies from flesh-color to light gray, and there are parts which should take a high polish and be valuable as marble. But the greater part of the mass is somewhat argillaceous, and the weathered surface shows many flaws and distinct lamination. The unequal composition of some of the thick beds unfits them for ornamental use, and their unequal resistance to the weather unfits them for building purposes. This series is well shown along the foot of Clinch mountain for many miles.

Nos. 5 and 6 are much alike, the great difference being in the relative quantity of limestone and shale, limestone predominating in the lower and shale in the upper bed. The limestone is more or less nodular in both. This mass reaches to the "bottom" of Little Moccasin creek and is well exposed on Mr. Ayres' property. No. 7 is concealed in the immediate vicinity of Estillville, but a roadside exposure shows it to be filled with yellow shale.

No. 8 is an important mass, economically as well as stratigraphically. It includes the marbles of the series. The beds are all massive, from 10 to 20 ft. thick, and are separated by thinner beds of shale. Many of them are finely granular, others have a conchoidal fracture; the colors are light gray, dark gray, reddish or flesh colored, brown and nearly black. Some of the beds are streaked with white calc-spar, other are fossiliferous, with the fossils replaced by calc-spar, so that the rock is beautifully mottled. This effect is most striking in the reddish marbles, some of which are in no wise inferior to the Tennessee marbles used in the National Capitol. The beds are so thick that blocks of any desired size can be obtained. These marbles are well shown in the streets of Es

tillville as well as along the railroad line for several miles beyond the village. They are well exposed at many points along Moccasin creek between Estillville and the Russell county line. The limestone of No 4 becomes more massive on Moccasin creek than it is nearer Estillville, so that, near the Russell county line, it might be mistaken for the marble. This series is shown in Copper ridge near Copper creek and in Big ridge, beyond Clinch river near Speer's ferry.

No. 9 is cherty. The bed immediately underlying the marbles is 12 feet thick and contains very little limestone. The rock directly under it is purer and has streaks of calc-spar with lumps of chert; but the chert gradually increases downward until, at little more than midway, it predominates. With it are some beds of reddish sandstone. Toward the base the limestone increases. This mass is well exposed on the Rye Cove road at barely half a mile from Estillville and its base is reached at a few yards above the mill; it is the first ore horizon of the Knox group. The extensive deposit of brown hematite on Col. Shoemaker's property near Estillville evidently belongs here, as does also the fine deposit on the Big branch of Moccasin creek at about 8 miles from Estillville. The quality of this ore is good, as appears from Mr. McCreath's analysis of samples from Col. Shoemaker's property, which is as follows:

Metallic iron	58.233
Sulphur	0.053
Phosphorus	0.075
Insoluble residue	3.840

Ore occurs at this same horizon on Copper ridge, having been opened on the McClennan property, near the Nickelsville road.

No. 10 is not fully exposed on the Rye Cove road and is better shown on the Stony Creek road. The limestone beds are from 5 to 15 ft. thick and are separated by beds of shale from 10 to 20 ft. thick. Very little chert was seen here. The interval, No. 11, is almost wholly concealed on the Rye Cove road and is but imperfectly exposed at other localities. On the former road, it is covered with red soil holding much jaspery rock and an excavation near its base has uncovered a thin silicious bed. At some imperfect exposures, seen elsewhere, it contains much white cherty rock. In all probability it is but a continuation of No. 12, which is very silicious and cherty in its upper part; but the limestone increases below, where chert is present only in irregular masses, which bear much resemblance to colonies of *Stromatopora*. Everywhere it shows more or less of oxide of iron and some of its cherty beds are honeycombed. Small pockets of black shale were seen in several places. This is the second ore horizon and many tons of brown hematite have been taken from it on Mr. Morrison's property near Estillville.

No. 15 is not shown in detail at any locality, but it is one of the most important members of the group, having been distinctly recognized at many localities along the summit of Moccasin ridge and along the middle and northern lines of summits in Copper ridge. For 50 or 60 ft., it is a silicious limestone, more or less ferruginous and cherty, which passes downward into a cherty rock resembling those already described and containing numerous thin beds of light gray sandstone. Below the middle a light blue limestone occurs, which weathers dirty white, and is persistent, having been observed at many places on both Moccasin and Copper ridges. Toward the base the mass becomes more and more calcareous until it passes finally into a coarsely granular massive limestone. The cherty beds are the horizon at which some of the most important ore deposits occur, brown hematite having been obtained at Mr. Poston's, in Moccasin ridge near Estillville, as well as at several other localities along that ridge; while on Copper ridge, extensive digging has been done at four places and fine blossoms were seen at many others. Oxide of manganese occurs here at one locality on Moccasin ridge and at two on Copper ridge. The manganese underlies the iron.

The limestones of No. 17 are well shown only on the southerly side of Moccasin ridge along the Stony creek road as it descends to Copper creek. They vary from flaggy to massive, from silicious to very pure, and for the most part are gray. Balls of chert were seen in some of the beds. Nos. 19, 20 and 21, are practically one. The upper part is massive and a fairly good limestone; it contains some fossils but they are indistinct. Further down, the rock becomes flaggy or thinner bedded and the silica increases, until the whole is little more than calcareous sandstone. Pyrites begins near the bottom of No. 19 and increases to the bottom of No. 21. This rock bears remarkably close resemblance to that which lies at the base of the Knox group along the line of the Hunter Valley fault.

Clinch mountain is a bold rugged ridge, very narrow, and showing a sharply serrate crest. For nearly 50 miles it has but one water gap, and its slopes are so steep that no wagon road passes over it within Scott county, while trails for riding animals are few and difficult.

The Medina sandstone is reached at the summit of the mountain, and for a long distance forms the southerly slope, the newer rocks being found only near its foot. It is exposed imperfectly in Moccasin gap, but its composition is shown there better than at any other locality within Scott county. The succession as there observed is as follows:

	Ft.
1. Massive sandstone, much of it conglomerate, dark gray to almost milk white	75
2. Massive sandstone, almost like quartzite, no grains shown on weathered specimens; weathered surface is rough and jagged; color on fresh surface, bluish white	150
3. Concealed, but evidently containing some shale as well as some white sandstone	30
4. Like No. 2, except that in some portions the surface of weathered specimens glistens, while the other always shows a dead white surface; weathered surface irregular	60
Total	315

In many respects, this rock bears much resemblance to the silicious beds of the Knox group; so much, indeed, that one would find difficulty sometimes in deciding the relations of a hand specimen.

Immediately above No. 1 of the section, there is in the gap a hard flinty rock belonging in all probability, to the Lower Helderberg. It is irregularly bedded, loaded with oxide of iron, contains no fossils, and is not more than 15 or 20 ft. thick. Above this come the Hamilton shales. The Clinton group and the Oriskany sandstone are evidently absent.

The Medina carries a brown hematite which has been examined at 3, 6, and 14 miles east from Moccasin gap. Samples taken from Mr. Ayres' property at 3 miles above the gap were analyzed by Mr. McCreath, with the following results:

Metallic iron	43.825
Sulphur	0.029
Phosphorus	0.926
Insoluble residue	19.910

Ore from another locality was mined for White's forge on Moccasin creek, and it is said by Mr. White to have proved even better than the ores from Moccasin ridge.

The lower Helderberg is fairly well shown at little more than 2 miles east from Moccasin gap, where a fine grained sandstone, almost a true grit, rests on the Medina conglomorate. It contains many fossils, mostly indistinct, among which are *Spirifer* and *Platyceras*, nearly allied to Lower Helderberg forms. This rock shows no traces of iron ore, but immediately above it is a fossiliferous brown hematite, which has evidently replaced a limestone bed. The ore is bulky, and consists chiefly of casts of a *Favosites*, which is somewhat coarser than *Favosites helderbergiæ*, and resembles more a form occurring in the Corniferous. A cyathophylloid coral was obtained from the ore, but it has been misplaced. No other exposure was found.

The Hamilton shales are exposed at the mouth of Moccasin gap and thence to a considerable distance up the side of Brushy mountain. Above these are the Chemung sandstones, containing *Spirophyton* and *Spirifera disjuncta*, and forming the crest of Brushy ridge, the first ridge of Brushy mountain. The second ridge of that mountain is made up of Lower Carboniferous rocks, which continue along the Reedy Creek road, to say a mile beyond the North Fork of Holston river. They describe a synclinal at the river. The abutments of the river bridge were constructed of rock from one of the higher limestones, which is composed almost wholly of *Fenestella*. The highest beds of the Lower Carboniferous are mostly bluish grits with some impure limestones, and are well exposed along the road as it follows a little ravine beyond the Holston river.

The fault of North Fork of Holston is reached along this road at about a mile from the river or near the head of the narrow gap just referred to. This uplift brings the limestones and cherts of the Knox group again to the surface and these continue as the surface rocks to the Tennessee line. Their features are the same as on Moccasin ridge.

A "poor valley" between Clinch mountain and the first ridge of Brushy mountain, extends from the Tennessee line to far beyond the limits of this reconnaissance in Washington county. The Hamilton shales are exposed at many localities in it, but the succession of the group is obtained best by tying the partial section made in Moccasin gap to that made along the railroad grade between Men-

dota and the North Fork of Holston. The estimated thicknesses are as follows:

	Ft.
1. Dark sandy shale, fossiliferous, shown in the railroad excavations	130
2. Yellow to ash colored shales, mostly well exposed in the railroad excavations, but the base seen only on the Abingdon road between Mendota and Moccasin gap; dip 45° to 50°	550
3. Dark fissile shale, with thin beds of sandstone, partial exposures between Mendota and Moccasin gap, but best shown in the gap	150
Total	830

The sandstone beds in No. 3 are fine-grained, very white and prove to be an excellent firestone. These are shown in the Abingdon road at several localities between Mendota and Moccasin gap. as well as just below the mouth of the gap. Much of this material was used for lining at Bushong's furnace, 40 miles away in Tennessee, to which it was carried by wagon. The shales are very dark, and at many localities along the foot of Clinch mountain they are as badly wrinkled as mica schist, but they show no evidence of metamorphism. Two thin beds of highly carbonaceous shale occur at the base of this group, which have been mistaken at several places for *coal*. They contain enough carbonaceous matter to burn and sometimes they yield a piece of fairly good *coal*.

The Chemung rocks are shown in all the ravines crossing the first ridge of Brushy mountain. An excellent exposure is afforded by the railroad excavation near the North Fork of Holston river, where the group is represented by shales and sandstone, mostly brownish gray and not far from 300 feet thick. A conglomerate layer, 4 to 6 inches thick, was seen very near the top and another of about the same thickness at 20 ft. lower. Fossils were found immediately above the upper layer as well as 10 ft. below it; among these are *Spirifera disjuncta*, *Atrypa aspera* and a *Chonetes*. For the most part the specimens are badly preserved, as the layers in which they occur are ferruginous grits and the fossils are recognizable only on the weathered surface. *Spirifera disjuncta* and *Productella boydii* were found on fragments of sandstone belonging midway in the group, and a *Spirophyton* covers many layers near the base.

The Chemung is succeeded by the lower member of the silicious group of the Lower Carboniferous. The two groups are conformable, and the junction is well shown in the railroad cut.

A good section of the Lower Carboniferous was obtained between this point and the Holston fault by following the railroad line. It is as follows:

Mountain Limestone group.

	Ft.
1. Sandstones, limestones and shales	800
2. Calcareous shales	60
3. Concealed	40
4. Calcareous shales	100
5. Limestone	105
6. Imperfectly exposed	250
7. Limestone	15
8. Shales	20
9. Limestone	50
10. Shale, imperfectly exposed	65
11. Limestone	15
12. Shale	80
13. Limestone	5
14. Shale	75
15. Limestone	20
16. Shale	150
17. Limestone	5
18. Shale	60
19. Limestone	80
20. Argillaceous limestone	60
21. Granular to argillaceous limestone	100
22. Argillaceous	35
23. Concealed	25
24. Granular limestone	30
25. Granular limestone	25
Total	2,270

Silicious group.

26. Cherty limestone	70
27. Granular limestone	35
28. Cherty massive limestone	65
29. Concealed	10
30. Limestone	30
31. Concealed	50
32. Limestone and shale	40
33. Massive limestone	125
34. Shales and thin limestones	90
35. Limestone	80
36. Calcareous shale	35
37. Limestone	25
38. Shales, sandstones and calcareous grits	100
Total	755

These thicknesses are all estimated except those from No. 7 to No. 15. No. 1 was seen in the gorge of Wolf creek; Nos. 2 to 20 inclusive were obtained along Abraham creek; Nos. 21 to 30 inclusive are exposed in the river bluff below the railroad bridge; and Nos. 31 to 38 are shown in the railroad excavations along the river bank.

No. 1 shows much the same features as in Pennington gap, as well as along the road leading southeast from Moccasin gap. Its base is reached at the forks of Abraham creek, at say one mile from the North Fork of Holston river. This mass forms the left hand wall of Wolf Creek gorge, through which the railroad passes for several miles. Here, doubtless, a detailed section could be obtained, but the wall is very steep and its ascent would be attended with danger. The greater part of the rock is a more or less ferruginous calcareous grit, much of which is dark blue on the fresh surface; but the iron and lime are easily leached out, so that, on exposure, fragments become "rotten" to a depth of several inches. Some portions are very fine-grained aud hard, so as to be fit for grindstones; these are well shown on a fork of Wolf creek, known as Whetstone hollow. A few of the beds are fossiliferous, but nothing can be obtained from a fresh piece, while the weathered specimens are so tender that specimens are ruined in the effort to free them from the rock. Huge stems of crinoids and some indistinct specimens of *Chonetes* were seen. The limestones are light blue, argillaceous and non-fossiliferous. The shales are usually reddish, but they form only a part of the mass. No massive sandstone was observed here such as was seen in Pennington and Big Stone gaps.

Nos. 2, 3 and 4 probably should be accounted as part of No. 1, but the shales, for the most part, are calcareous and resemble some lower beds more than than they do those of Wolf creek. The shales, Nos. 8, 10, 12, 14, 16 and 18 are light blue to reddish blue on the fresh surface and weather to a dirty or muddy yellow. A fresh edge seldom shows lamination, but the weathered surface shows it distinctly. These beds are generally well exposed in the bed of Abraham creek, alongside of which the railroad grade runs. Fossils occur rarely in these shales, and the only distinguishable specimens seen belonged to a broad form of *Spirifera leidyi*.

The limestone, No. 5, well exposed at the roadside and in the hills at but a little way below the mouth of Wolf creek is blue, but weathers yellowish white; it is composed chiefly of a *Fenestella*, but some layers have many specimens of *Athyris* and *Productus*. Nos. 7 and 15, both of which are well shown in the creek bed as well as in the hill, have a similar origin, and the *Fenestella* is distinctly shown throughout with only a rare *Productus* and *Zaphrentis*. These two beds are exceedingly hard. No. 15 is the same with that of which the bridge abutments for the Reedy Creek road were constructed at the North Fork of Holston river.

No. 6 continues from Mr. Kaylor's residence on Abraham creek down the stream almost to his mill, at probably two-thirds of a mile from the river. It has more than one bed of limestone and is closed by a sandstone at the top. Below this interval, the section is almost continuous to the base of the series. No. 9 is shown at the mill; it varies from light to dark blue or almost black, and shows many stems of crinoids, with *Fenestella* and a *Spiriferina* closely allied to *S. kentuckensis*. No. 11 is a handsome light blue limestone and contains *Athyris subquadrata*, *Productus cora* and crinoid stems, which occur also in Nos. 17 and 19. No. 21 is an important bed, which is shown at the mouth of Abraham creek and forms a broad band on the cliff around the bend of the river below the railroad bridge. For the most part, it is coarsely granular and dark gray, but it contains some argillaceous layers and becomes a blue grit near the base. It yields an admirable building stone, of which the bridge abutments and pier have been constructed. The rock is very pure and burns into a beautifully white lime, which shows no trace of iron when slaked.

No. 22 is argillaceous and its fragments cover the narrow bank below the bridge. This is by far the most fossiliferous bed of the whole series; *Productus cora*, *Productus elegans*, *Athyris subquadrata*, *Spirifera leidyi*, *Hemipronites crassus*, *Pinna* and *Allorisma* having been obtained from a small block. Perhaps this should include also the concealed interval below it.

Nos. 24 and 25 are very similar to No. 21; they are granular, and No. 24 is massive. No. 25 is more or less flaggy, and passes into a hard, cross-bedded calcareous grit, which contains not a little chert.

The limits of the two groups are very distinct, and only a few feet at the bottom of No. 25 mark the transition. Below that line, chert is present in nearly every bed. Nos. 26, 27 and 28 are alike, except that very little chert occurs in No. 27. Many layers of No. 26 are crowded with bryozoans, and the smaller nodules of chert are casts of *Productus*. Crinoid stems are abundant in No. 28, which is massive and cherty throughout. No. 33 is well exposed in the railroad excavation; its higher beds are dark gray, streaked with white calc-spar and contain much chert, some of

which certainly has replaced a *Chætetes*-like form. Fossils occur in the highest beds, where sections of *Productus*, *Athyris* and *Pleurotomaria?* are abundant; the lower beds are massive, almost black, and show only minute fossils. No. 35 is very cherty in its upper and massive layers, but the lower layers are somewhat flaggy, show little chert, and are crowded with crushed fossils, chiefly *Hemipronites* and *Athyris*. No. 37 is flesh-colored to light blue, and is well exposed at the mouth of a hollow nearly half a mile from the bridge over North Fork of Holston. There it describes a short abrupt anticlinal, which is nicely shown in the railroad side-cutting. This bed is the base of the upper member of the Silicious group.

No. 38 is the Protean member of the Silicious group. It is not fully exposed as the little hollow, already referred to, intervenes between the last exposure of the limestone and the first exposure of this mass, the concealed interval being perhaps 35 or 40 feet. But under the petty anticlinal, the upper part of No. 38 is shown within 5 feet of the limestone, the interval being filled with some drab clay, which may belong with either No. 37 or No. 38. The upper part of No. 38, as far as seen, is a fine-grained sandstone with smooth fracture, but this passes downward into shales containing a bed which is highly carbonaceous. The rocks below are fine-grained sandy shales with beds of blue calcareous sandstone or grit, very fine-grained and breaking with irregular fracture. These are very similar to the beds seen in No. 1 of this section. It is possible that *coal* occurs in the concealed part of this mass, for a *coal bed* is said to be present under the river directly opposite the mouth of the little hollow. The only fossil seen in these rocks was a fragment, which probably belongs to *Leiorhynchus*.

These beds rest conformably on the Chemung, as already stated.

The dip of the rock varies. In No. 35 it is nearly 20°; in No. 25 it is 33° and the strike is N. 60° E. mag.; but here the rate increases, and in No. 24 it becomes 40°, which is the prevailing rate of dip up to within 300 yards of the mouth of Wolf creek, beyond which no measurements were made. It is not at all improbable that a fragment of the Quinnimont group remains on the high land between Abraham creek and Wolf creek.

The Holston uplift is reached at the summit between Wolf creek, North Branch, and the "rich valley" of Abraham creek. There, one comes to the limestones of the Knox group, in contact with the highest rocks of the mountain limestone group, and two miles further along the railroad line the cherty beds of the Knox group are exposed. These are shown very near to Walker mountain at a cross-road, where the soil is very ferruginous. The limestones of the overlying group are shown at but a little way from the gap by which the railroad passes through Walker mountain.

A well-marked fault was crossed just behind Walker mountain at somewhat more than four miles from Bristol, where the pyritous calcareous sandstones of the Knox group are shown in the gap through that ridge. The dip is abrupt at the head of the gap and increases to the mouth, where it becomes nearly 50°, and the shaly layers are badly twisted. Exposures are very obscure between this locality and Bristol, where the line of section terminated; but the limestones of the Knox group are shown here and there, and the cherty beds of that group pass very near to Bristol.

Low Moor Furnace, on C. & O. Ry, Alleghany county, Va.—Our last report from this furnace was to Jan. 22, 1881, the 91st day of current blast. From Jan. 23 to March 12, inclusive, 92nd to 140th days of present blast, including about 5 days of stoppages, it made some 3,350 tons of pig iron from about 2,440 tons of lump and 5,270 of wash ore, and 4,000 tons of coke; fluxed by some 4,075 tons of limestone. The output from Jan. 1 to March 12, 1881, has been about 4,630 tons of pig iron of various grades.

A leading iron-master, from W. Va., from the B. & O. RR., called on us a few days ago to enquire where he could find neutral ores to mix with the carboniferous ones he is now using, to improve the quality of the pig iron he is making; in the course of conversation we learned that this necessity was forced upon him by the demands of Western markets, that of Cincinnati especially, in consequence of the quantity, quality and price of the Low Moor and other Virginia irons giving them control of those markets.—This is a condition of things we have heretofore predicted. The iron and coal regions of the Virginias have all the requisites, at this time, for making better and cheaper iron than any other portion of the United States.

The Coal and Coke Movement, from the mines, over the Chesapeake and Ohio R'y, for the month of February, 1881, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Mr. Charles M. Gibson, the Fuel Agent for the Company, were as follows:

	1880.	1881.
Fuel for use of Company	8,264	11,733
Shipped at Huntington on the Ohio river	9,518	5,579
Delivered on line of Elizabeth, Lex'n & Big Sandy Railroad		2,365
" " Chesapeake & Ohio R'y. west of Richmond	2,839	9,325
" at Williamson to Richmond & Alleghany Railroad		143
" Staunton to Balt. & Ohio Railroad, Valley Division		110
" Waynesboro to Shenandoah Valley Railroad		46
" Charlottesville to Va. Midland R'y	1,970	3,955
" Gordonsville to do. do.	37	26
" Hanover Junction to R. F. & P. Railroad	1,556	941
" Richmond for consumption, including steam-tugs and dredges	3,643	8,612
Shipped at James River wharves	6,897	11,601
" Newport-News wharves		
Total	34,724	54,436

The increase in the total movement in February, 1881, over February, 1880, was more than 56 per cent. Especially noteworthy is the increase in deliveries to the E. L. & B. S. RR., to points on the line of C. & O. Ry., to Richmond for consumption, and to James River wharves for shipment.

The character of the fuel moved during the same periods, is shown in the following exhibit:

	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Total.
For the month of Feb., 1881,	401	15,892	13,965	18,953	5,225	54,436
" " " 1880,	1,861	.....	30,887		1,976	34,724
Increase, 1881	.....	.....	17,923		3,249	19,712
Decrease, "	1,460	.....	.....		.....	.....

In the "New River and other steam coals" is included the product of the Eagle, and Gauley Mountain mines.

The very large increase in the shipment of all the kinds of coal mined on this road (except cannel), and of coke, in Feb., 1881, over Feb., 1880, indicates an extremely healthy condition of the fuel traffic from the West Virginia coal-fields traversed by the C. & O. Ry.

The movement from January 1st to February 28th, 1880, and 1881, was as follows:

From January 1st, to	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Total.
February 28th, 1881,	847	33,983	25,848	37,421	9,798	107,897
Same period, 1880,	5,426	.....	70,503		3,747	79,676
Increase, 1881,	.....	.....	26,749		6,051	28,221
Decrease, "	4,579	.....	.....		.....	.....

The increase in the total movement in January and February, 1881, was more than 35 per cent over that for January and February, 1880. The gain in movement of coke was more than 161 per cent.

Mineral Co., W. Va.—About 1,000 tons of semi-bituminous coal were mined in this county in 1880, from small coal mines; most of it for local use. The "Davis" mine of H. G. Davis & Brother, 2.5 ms. S. W. from the B. & O. RR. at Piedmont, with which it has connection by a tramway, was opened in the early part of the year.

Elm Colliery, Caperton station, C. & O. Ry., Fayette Co., W. Va., changed hands the first of this year, the firm of Beury, Cooper & Williams was dissolved, Wm. G. Williams and Jos. L. Beury retiring; the new firm is Wm. Beury, Cooper & Co., Beurys P. O., Fayette Co., W. Va.

A Richmond, Toledo & Chicago RR. Co. has filed articles of incorporation in Fayette Co., W. Va.

Note on a Deposit of Cadmia in a Coke Furnace.

By H. Firmstone, Longdale, Alleghany Co., Va.

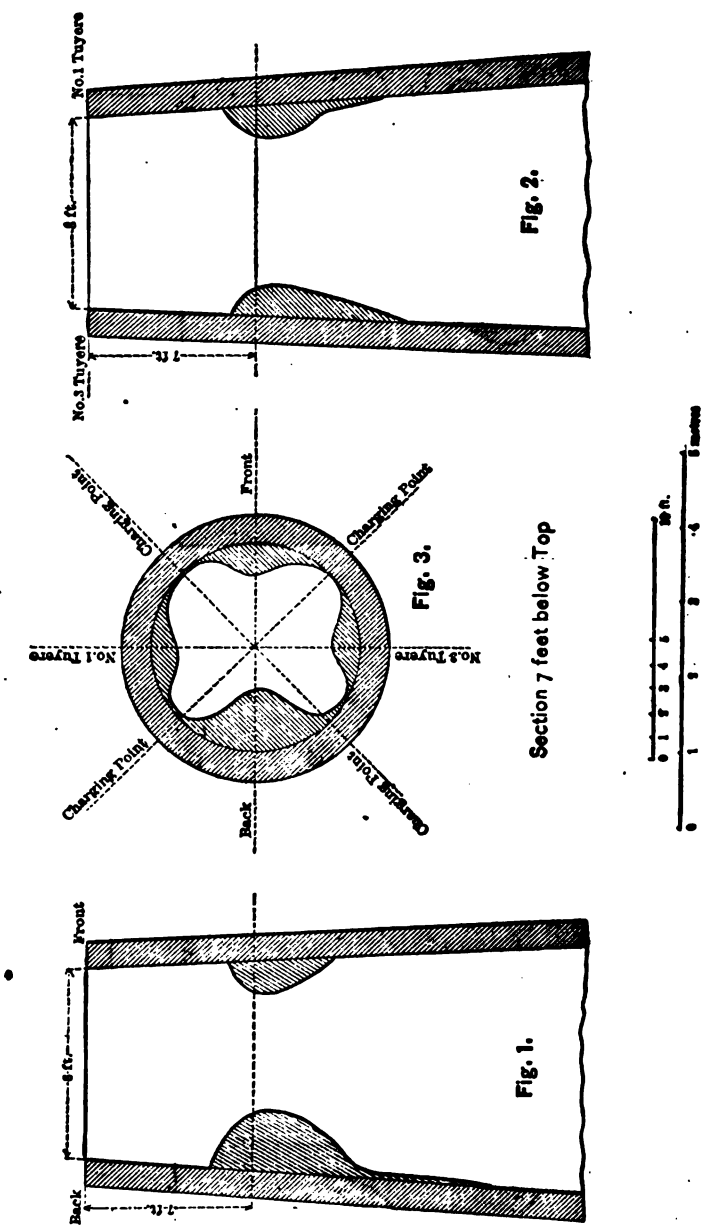
(*From Vol. VII, Trans. Am. Institute of M. Engs.*)

Deposits of cadmia, or impure oxide of zinc, are of common occurrence in the upper parts of blast furnaces using ores containing zinc, and were very common in the charcoal furnaces of Virginia working the brown hematite ores found near the Cadent black slate. These deposits were known to the old charcoal founders as "sulphur rings," and the characteristic green flame of burning zinc frequently to be seen at the tymp of furnaces working ores containing zinc, was held by them to indicate the presence of a "sulphur fall." When zinc is burning in considerable quantities at the tymp, the pieces of charcoal shoveled from the front are frequently covered with oxide of zinc, and while hot this oxide is of a yellow color, resembling somewhat flowers of sulphur, which tended, no doubt, to strengthen their belief that sulphur was present. These charcoal furnaces having, as was customary, very small tunnel-heads, frequently became much obstructed by the zinc deposits, and it was a common thing for them to be blown down for the purpose of "burning out the sulphur ring," it being supposed that the heat at the top while blowing down tended to remove the obstruction. How far this may have been the case is not known to the writer, but from the persistent manner in which they remain during blowing out in the top of a coke furnace with which he is familiar, he should judge that but little good was done by the operation.

Such deposits then being of common occurrence and so familiar to furnacemen, it will be the object of this paper merely to call attention to the large size and peculiar shape assumed by one of them in a coke blast furnace, the shape being determined by measurements taken after blowing out. Since it is very important for a proper discussion of all questions in relation to blast furnaces that all the data should be known, the dimensions, etc., of the furnace will first be given. The furnace in question is 60 feet high and 11 feet diameter at the largest place, which is about midway of the height; the tunnel-head is 8 feet diameter, and the furnace is filled by a modification of Coignt's charger (or double bell), as described by Mr. F. Firmstone (Vol. II, of *Transactions*, page 103), the gas being taken off by a central pipe. The hearth is 6 feet diameter, and has three tuyeres. About 3700 cubic feet of blast per minute is supplied to the furnace, at 3½ pounds pressure per square inch, the temperature of the blast being a full lead heat, rarely melting zinc. The coke used is New River coke, from West Virginia; the iron ore is brown hematite, obtained near the furnace in Alleghany County, Virginia, and contains about 46 per cent of iron. The limestone is a pure carbonate of lime, supposed to correspond to the Pre-meridian limestone of Rogers' Pennsylvania survey. Twenty hundredweight and three-quarters (20¾ cwt.) of coke are consumed in making a ton of gray-forge pig iron, the furnace producing about 185 tons of iron per week. The cubic contents of this furnace is about 3900 cubic feet. Several analyses of average samples of the iron ore have been made, but in no case was any zinc found. The same is true of the coke and limestone. The zinc undoubtedly comes from the iron ore, but must have been missed each time in sampling.

The deposit of cadmia, which it is the special object of this paper to describe, was formed during a fourteen months' blast, the furnace having been blown in September, 1876, and blown out November, 1877. In Fig. 1, a vertical section of this deposit is given, the section plane passing through the front and back of the furnace. In Fig. 2, a similar section is given, the plane passing through the two side tuyeres, Nos. 1 and 3. In Fig. 3, a horizontal section of the deposit or ring is shown, the section being taken at about the centre of the ring, or 7 feet from the top of the furnace. The materials to fill the furnace were dumped into the charging apparatus at four places, and the position of these four places on the circumference of the lining is marked on the horizontal section, as is also the position of the centres of the tuyeres below.

It is the peculiar form of this deposit, as exhibited by the horizontal section, that makes it interesting, and particularly so when compared with a horizontal section of a blast furnace described by Mr. F. Firmstone, and published in the *Transactions* (Vol. IV, page 128), in which it was shown that the lining of the furnace was worn into six grooves at equidistant points on the circumference. In this case the materials had been dumped into the furnace (open top) at six equidistant points on the circumference, the grooves being midway between the points at which the stock was dumped in, as also midway between the centre lines of the tuyeres below. An examination of the horizontal section of the ring of cadmia (Fig. 3), shows it to have four prominent points directly over the tuyeres, and midway between the points at which the stock was dumped in, while directly under these last-named points there is but little deposit. In either case it seems most probable that the position of the tuyeres had nothing to do with the thing, but most likely it has been caused by the distribution of the materials. The shape of the ring of cadmia, with reference to the points at which the stock was dumped in, is just the reverse of that of the section of blast-furnace lining above referred to, as, indeed, the two cases of their formation are the reverse one of the other, one being a deposit



(from the gases) on the lining, and the other a wearing away of the same; the projections in the one case and the grooves in the other, in all probability indicating the course of the ascending gases, for it seems plausible that we should look for the largest zinc deposit where the largest amount of gas passes, since the zinc incrustation is deposited from it. It is to be hoped that the presentation of this paper may bring to discussion some of these interesting, and to furnacemen, important questions.

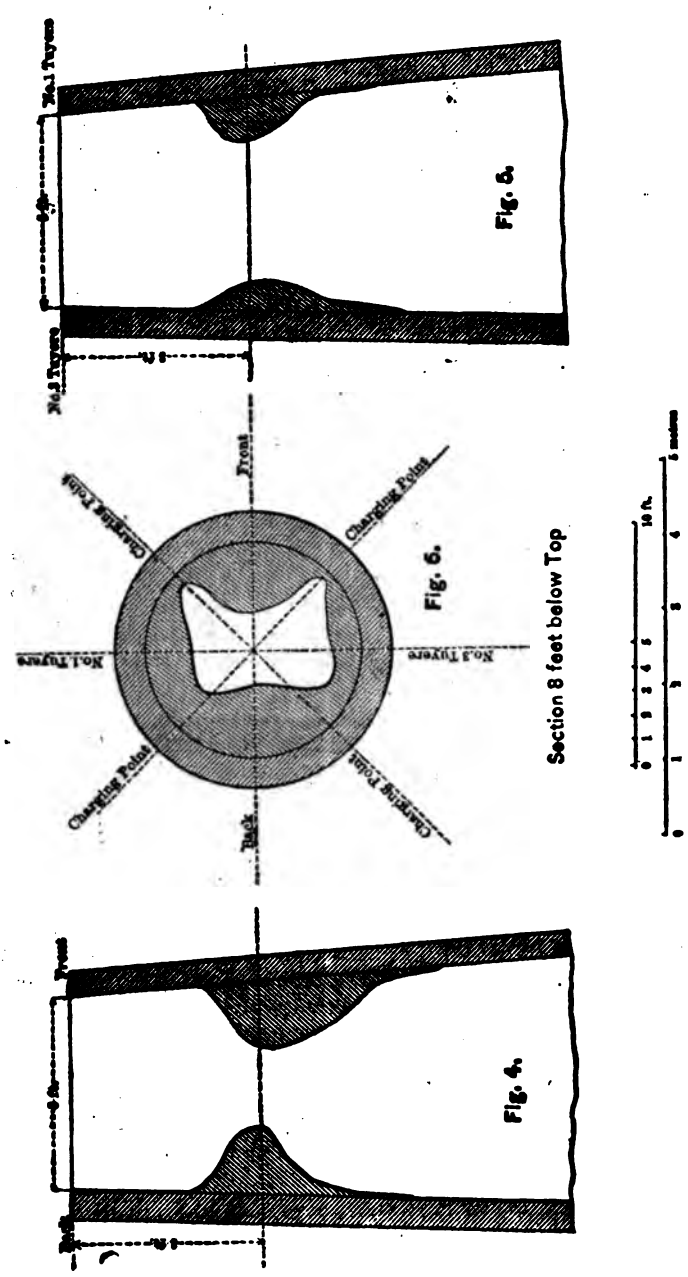
When this paper was read at the last May meeting of the Institute, the writer was in possession of the measurement of but one of these deposits, but since that time, the blowing out of the same furnace, after a little less than ten months' blast, has put him in possession of the measure-

ments of another deposit of cadmia, much larger than the one described, and which seems to follow the same law in its formation, although in not so marked a manner. This, however, would appear to be due to the much larger size of the deposit, the tunnel-head of the furnace being much more nearly closed than in the first case. Considerably more ore was used during the ten months' blast than during the previous fourteen months' blast, the output of the furnace having been greatly increased, and hence the larger size of the deposit in a shorter time. This second deposit is exhibited by Figures 4, 5 and 6, in the same manner as the first.

The first deposit on being removed from the furnace was found to weigh 4 tons 6 cwt.; the second, 12 tons 4 cwt. Both deposits were sold to a zinc company, I presume for conversion into spelter. An analysis of a piece from one of these deposits resulted as follows (by Dr. T. M. Drown):

Silica,	0.94
Iron (mostly metallic),	2.44
Oxide of lead,	0.90
Lime,	1.22
Oxide of zinc,	93.89
Carbon, by loss,	0.61
	100.00

It would seem that such deposits as this ought to greatly interfere with the regular descent of the charges, and thereby



with the furnace carrying burden; but such was not the case here, the furnace having, during both blasts, carried a good burden up to the last, and having worked quite regularly, although in the last case the burden was not quite as heavy nor the work quite as regular as earlier in the blast. It will no doubt be necessary in the case of longer blasts being made at this furnace, to blow down occasionally, and cut out the deposit (a job that will not be easily accomplished, as the substance is very hard), and take it out of the top of the furnace, not allowing it to descend into the hearth.

The furnace in question has spells of several days' duration, when the hearth is filled with the flame of burning zinc, and scarcely anything but this characteristic green flame can be seen at the cinder notch and tapping-hole. Pieces of zinc are carried along on the surface of the cinder and iron while running, giving off the green flame as they pass, and leaving on the top of the cinder a deposit of oxide of zinc, yellow while the cinder is hot, but changing to a pure white when cold. One of the most peculiar things in this connection, and one which the writer never heard mentioned before, is the escaping of metallic zinc through the cracks of the hearth. This takes place at the level of the tuyeres, and thence up for a height of three or four feet. One hundred to one hundred and fifty pounds might possibly be collected in this way during a year's run. In tearing out an old hearth, many of the bricks are found permeated by globules of metallic zinc, the bricks being much shattered. Whether the bricks are first shattered, and the zinc then runs into the cracks, or whether the zinc is instrumental in the shattering, is an unsettled question, but it is quite certain that great difficulty has been experienced in getting the hearths to stand.

Coal Mining in West Virginia.

Tucker county, though possessed of considerable areas of the Lowest Coal group, Formation X, and of the Lower and Middle Coal groups, XII and XIII,—had no mining done within its borders in the year of the 10th Census, so far as can we learn.

Pendleton county, though traversed by Upper and Lower Silurian belts with iron ore bearing strata, had no mining of any kind done within its borders in the 10th Census year, from present information.

Grant county, had 21 small coal mines operated for local use during the 10th Census year, in the S. W. extension of the Cumberland basin, in semi-bituminous coal. In the Union district, on North Branch Potomac waters, N. W. of the Alleghany mountain, there were 6 mines that furnished about 200 tons from a 3-ft. bed; on Looney creek of South Branch Potomac there were 5 mines in a 6-ft. bed from which about 140 tons were mined; in Patterson district, on Patterson creek, there were 8 mines in an 8-ft. bed from which some 275 tons were mined;—so about 600 tons was the county output.

Randolph County, had 15 small coal mines worked for local consumption during the 10th census year, all in a 7-ft semi-bituminous bed. In Beverly district were 8 mines from which about 670 tons were taken, the larger part though from one mine, that of S. B. Hart; in the Alleghany district there were 6 mines from which about 170 tons were taken; the Pittston Coal Co., of Roaring creek, mined over 800 tons, which, as well as Hart's, found a market in Beverly.—The county product was probably about 1,700 tons.

Irondale Furnace, Raccoon, Preston county, W. Va., (New York office 43 New St., Room 9,) of which F. Nemegyei is proprietor and Alex. Strausz general manager, was in blast 9 months in 1880, and made 5,810 tons of foundry and forge coke pig iron. Its mines and quarries, at the furnace, were worked 11 months in 1880 and produced 22,000 tons of iron ore, 14,000 of coal, and 7,000 of limestone. Its iron ore is composed of iron carbonate 63.61, iron sesquioxide 2.56, lime carbonate 14.32, magnesia carbonate 7.83, manganese 0.29, lime phosphate 4.65, alumina 1.50, silica 4.55, and moisture 1.08; total 100.39. Its limestone is composed of lime carbonate 86, alumina 3.50, silica 5.50, and magnesia 5.00; total 100. Its coke is composed of carbon 90, sulphur 0.70 and ash 9.00.

The tidal James river is to be immediately surveyed for the purpose of ascertaining the cost of deepening its ship-channel to 25 feet; the last Congress made an appropriation for this purpose and the War-secretary has ordered the survey.

Manganese Trade of 1880 and 1881.

OFFICE OF CRIMORA MINING COMPANY,
WAYNESBORO, VA., March 24th, 1881.

EDITOR OF THE VIRGINIAS:

Dear Sir:—My London correspondent has just sent me some statistics of the manganese trade of Europe for 1880, with an account of stocks on hand and estimated consumption for 1881, which, with extracts from his accompanying letter, I send you for publication. They may interest some, at least, of the many readers of your valuable paper.

It appears that Spain, Portugal and Virginia can more than supply the estimated consumption of manganese for 1881, without drawing at all on the 15,000 tons that Georgia, Canada, Asia Minor, the Caucasus and New Zealand, can furnish, leaving out of view all other manganese producing portions of the world, which will produce at least 8,000 tons more if prices will justify its being mined and thrown on the market.

The importation of manganese ore into European ports during the year 1880, in tons, was:—From Spain, Huebla, 19,370, Asturias, 1,004, Valencia, 294; Portugal, 7,029; Italy, 18; Sweden, 172; Asia Minor, 1,032; the Caucasus, 2,613; Cape Colony, 205; New Zealand, 2,049; Canada, 2,309; Virginia, 2,563; Georgia, 2,361; Monte Video, 20; English mines, 480;—total, 41,519.

As the arrivals in 1880 were 41,552 tons, and it was estimated that 9,000 tons were on hand at the close of the year, the consumption was 32,552 tons.

The estimated consumption for 1881 is 35,000 tons; so 26,000 tons, with the 9,000 on hand at close of year, will supply the demand, or adding 4,000 tons for ordinary stock, only 30,000 tons will be required in 1881.—Of this Spain can furnish 18,000 tons, Portugal 10,000, Virginia 2,500, Georgia 2,500, Canada 2,500, Asia Minor, 2,000, the Caucasus 4,000, and New Zealand 2,500; total 44,000 tons. The quantity from Spain and Portugal will be reduced if price is lowered.

Our correspondents write: "We enclose details of figures for 1880. You will notice the great advance in the consumption of ore for metal purposes, and also the enormous increase in the quantity sent from Spain and Portugal, especially from Huebla district, the mines of which are numerous and very good. We act as selling agents for all the Huebla shippers, and have had great trouble to prevent any flooding of the market.

Without a little explanation the figures are apt to mislead. You will see that the total quantity moved was 41,552 tons, but the real consumption for 1880 was 32,000 tons, as near as possible, and all the balance is in the various works. In the majority of the works there are stocks for quite 3 months' consumption. This is the reason for the present flatness of the market, and why we say that there cannot possibly be any rise in the price.

The amount of mineral in store at various depots is very much the same as at the end of 1879, when we estimated the 1880 consumption at 25,000 tons. We are glad that we were under the mark. The consumption reached 32,000 tons. There will not be a large increase for 1881. We do not think that more than 35,000 tons will be used, and, seeing that there is already so large a stock in the hands of the consumers, we believe that a supply of 30,000 tons will be ample for all purposes. Anything in excess of that quantity will simply pull down prices and be added to stocks.

The figures we give will let you know exactly how things are placed. Evidently the supply is ample enough, prices being governed entirely by the cost of raising and transit. The market is in the hands of those who are most favorably placed, and there is no room for large profits for any one. It is in a healthy enough position, no doubt, as it is a pretty sure one, and not likely to give rise to violent fluctuations of price, but miners, as a rule, prefer better profits."

The foregoing is sufficient of itself, and nothing need be added for the benefit of the many who are so anxious to engage in the manganese trade. Yours truly,

W. A. DONALD.

Bradstreet's, of New York city, a leading journal of Trade, Finance, and Political Economy, proposes to publish a series of articles "on the development, present and prospective, of the mineral interests of Virginia and West Virginia."

E. K. Hyndman, Esq., of Connellsville, Pa., was, at a recent meeting of the stockholders, elected President of the Tinsalia Coal & Iron Co., which is now, under the management of Gen. John D. Imboden, developing the coal and iron ores of S. W. Va. that Dr. Stevenson so well describes in this and the preceding number of THE VIRGINIAS. Mr. Hyndman is President of the South Atlantic & Ohio RR. Co., one engaged in constructing a great through line of railway from Kentucky to Wilmington, N. C.; he was formerly, for 9 years, the remarkably successful superintendent of the Pittsburg division of the Baltimore & Ohio RR., and has recently been the general manager of the Connellsville Coke and Iron Co.,—the largest corporation engaged in coking in Pennsylvania, or in the United States,—in which he was also a large stockholder

Mr. Hyndman has become so much interested in the operations of the Tinsalia Coal & Iron Co., and in the construction of the Bristol Coal & Iron Narrow-gauge RR., the outlet from its mines to market, and in the extension of that road to the Atlantic, that he has sold all his interests and given up his lucrative positions in the Connellsville region and not only largely increased his already large investments in the Tinsalia Co., but will also hereafter make Va. or N. C. his home, and devote all his means and ability to the work of this company, taking immediate control of all its railroading, and managing its financial and mercantile operations. Gen. Imboden will reside at the mines, at "Imboden," and manage the local productive operations, where he will have a fine field for the exercise of his great executive talents.

It is very gratifying to us to be able to announce, as as we do authoritatively, these *permanent arrangements.*

We feel that the development of these States is assured when men of such means, positions and experience as Mr. Hyndman, after a careful examination of all the existing conditions, find to their interest to sell out in the most flourishing mining and manufacturing portion of the United States, in Pa., and invest their all in mining and manufacturing in Virginia. There can be no question in reference to his ultimate success,—we hope it may be speedy and abundant, and that many more like him may follow his example. All things invite them to do so.

Richmond & Danville Railroad Co. has leased the Atlanta & Charlotte Air-Line RR., so that it now controls 1,422 miles of railway, extending from Richmond, Va., to Augusta and Atlanta, Ga., and Point of Rock, Tenn., making it, greatly to the advantage of Richmond, one of the far-reaching lines of trade and travel to and from the southwest. It pays for the use of this road 7 per ct. interest on its mortgage debt of $4,750,000; 6 per ct. on $450,000 of income bonds; and 5 per ct. on $1,700,000 of stock, spends $100,000 yearly in improvements; and puts up $500,000 as a guarrantee. Possession is given April 1st. and R. & D. has decided to at once increase its equipment with 12 mogul locomotives and 1,000 box-cars, in addition to the 8 mogul locomotives and 200 freight-cars recently purchased. This is one of the most important movements ever made for building up the commercial interests of Virginia, and it shows that there is a plenty of life and pluck in the old state when one of its corporations can win, as it did in this case, in a direct contest with the great and powerful corporation that has made Baltimore the commercial emporium that it is.

Hydraulic cement is made near Shepherdstown, Jefferson county, W. Va., on Shenandoah Valley RR., by Harry W. Blunt who quarries some 6,000 cubic yards of hydraulic limestone, annually, from a quarry in the bluff of the Potomac, opened in 1830, and from which some 200,000 cubic yards have been quarried, and converts the same into cement at kilns and mill near the quarry.—Jefferson county furnished no mining statistics to the 10th Census but those of this cement works.

The Gardener's Monthly and Horticulturist, of Philadelphia, for March, is, as usual, not only promptly at hand, but its 30-odd pages are full of most valuable information in reference to flower gardens and flower grounds, green houses and house gardening, fruit and and vegetable gardening, forestry, natural history and science, literature, travel, horticultural societies, &c., &c. Terms $2.10 a year. All lovers of flowers, fruits, gardens, etc., should have this monthly.

Buckingham RR. Co. was organized March 2nd., 1880, with F. O. French as president, James B. Ficklin vice-president, E. R. Leland secretary and treasurer, and R. H. Temple chief engineer. The directors are F. O. French, (president of Richmond & Alleghany RR. Co.) Hugh McCulloch, Lawrence Myers, J. J. McCook, James B. Ficklin, Robert T. Hubard, and J. T. Rogers. The object of this company is to construct a railroad from Bremo station of the R. & A. RR. across James river to New Canton, thence up Slate river, to the famous Buckingham slate quarries and on across Buckingham county by the C. H. to some point on the Norfolk & Western (A. M. & O.) Ry.

Slate.—The Richmond & Alleghany Coal & Iron Co. has opened a slate quarry, on the Bedford side of the James 3 miles below Bacony Falls, on the line of the R. & A. RR. It is said to be of a good quality.——The "Baldwin" slate quarry, in Amherst Co., is now successfully worked; it is not far from the R. & A. RR. at Rope-ferry. Both of these quarries are in the Archæan slates of the eastern slope of the Blue Ridge.

The Commodore G. Mining Co., to do a general mining business in Goochland and Fluvanna counties, Va., has filed articles of incorporation in New York city. Incorporators: F. Shepard, T. J. Van Wyck, P. W. Hohines. Trustees, J. T. Salter, S. Mead, H. Dayton, A. F. Phelps and the three incorporators. Capital; $250,000 in $1 shares. Term; 50 years.

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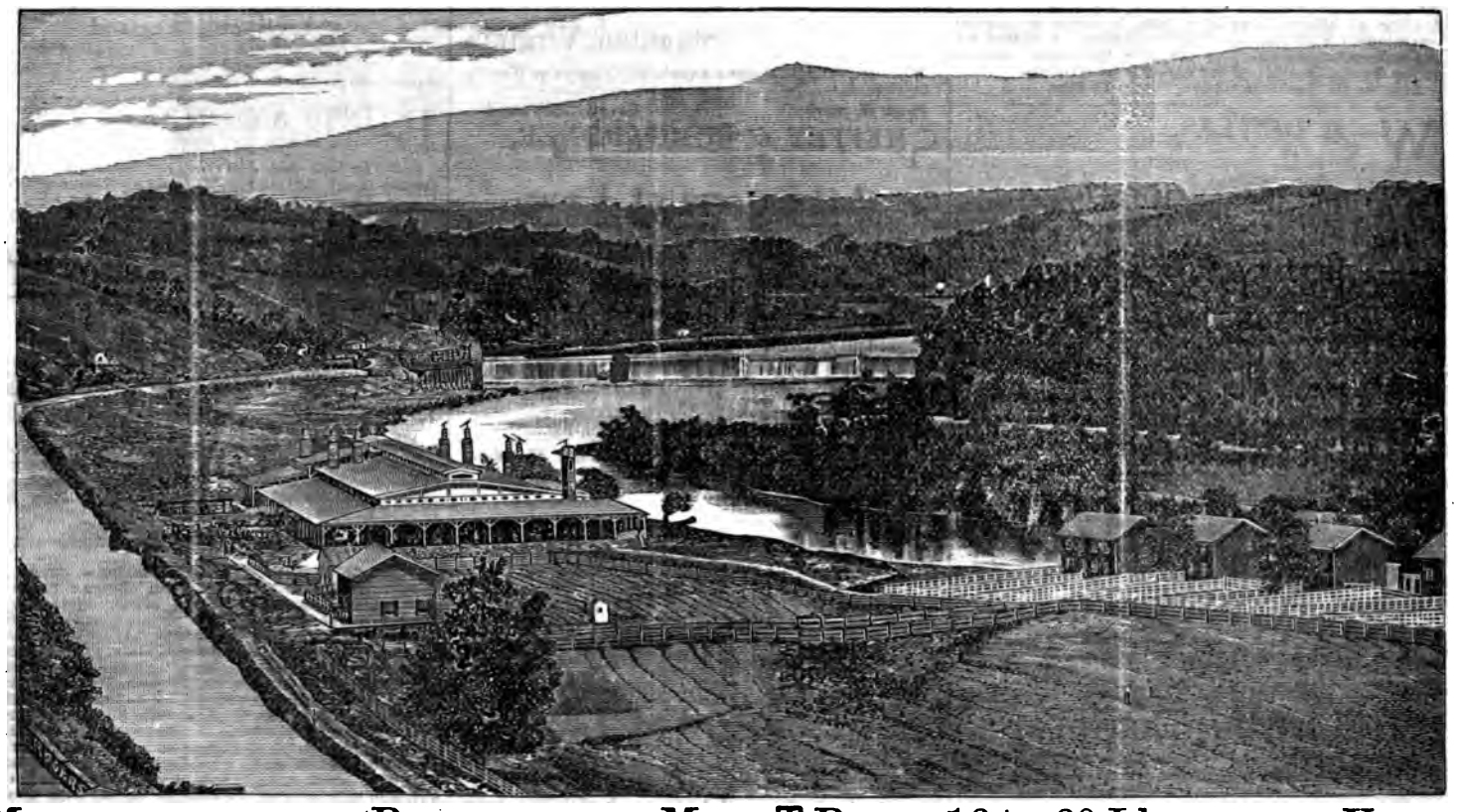

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THE VIRGINIAN is an independent Republican newspaper, devoted principally to the interests of the Great Valley, and Mineral Regions adjacent thereto. Its circulation is larger than that of any other weekly newspaper published in Virginia. As an advertising medium, especially for farming, grazing, and mineral lands, &c., it has no superior. Parties desiring to buy or sell real estate will find it to their advantage to make use of its columns. Specimen copies free.

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129 E. Main Street,
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The "SPECTATOR" is published every Tuesday morning, at Staunton, Augusta county, Virginia, and is the best advertising medium in the interior of the State.

The "Spectator" was the first paper established at this place, nearly a century ago, and it is now in its 57th volume, under its present title. Its list of subscribers is larger than that of any other paper west of the Blue Ridge, and is, therefore, the best advertising medium in the Valley of Virginia, or in West Virginia. Address "STAUNTON SPECTATOR,"
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THE CHESAPEAKE & OHIO R'Y

Is the Only Route to and via the White Sulphur Springs and other most famous and fashionable watering places of the mountains of the Virginias.

It is the unparalleled and unapproachable for the wildness, sublimity and picturesque beauty of scenery, and the healing virtues of its health-giving fountains. It is the **Short Line Between the Seaboard and the Great West,** and is second to none in costruction, equipment and appliances for the safety and comfort of its passengers.

Through Tickets to all Western towns and cities, and excursion tickets to the watering places and summer resorts, are for sale via this line at all principal ticket offices everywhere.

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JOHN J. STEVENSON,

Professor of Geology in the University of the City of New York,

Will be at liberty, after May 20th, to make geological examinations of coal and iron properties. Analyses for his reports will be made by Mr. A. S. McCreath, chemist to the Second Geological Survey of Pennsylvania.
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Offers his services in the making of geological examinations, surveys or reports; in superintending the experimental development of mineral land and negotiating purchases. Agent for Pennsylvania Diamond Drill Co.

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The Mineral Lands of Southwest Virginia, in the Blue Ridge, Valley, and Apalachian Districts a SPECIALTY. Correspondence solicited.

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Examines and Reports on Mineral Lands and their Titles; makes Geological and Topographical Surveys, Maps, &c. May be consulted in reference to purchase of lands in Va. and W. Va.

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Engineering and surveying of all kinds promptly attended to.

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Analyses of iron ores, limestones, coals, cokes, and all materials relating to the iron industry made, and returns sent promptly.
Prices reasonable, and enquiry can be made of any of the large iron companies here as to accuracy of work.—Samples can be sent by mail at one cent per oz. Address
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Analysis of metallurgical supplies and products of every description furnished promptly, and on reasonable terms.
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Attorneys,—Virginia.

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Attorneys at Law,
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Titles to Mineral and other Lands, in Virginia and West Virginia, carefully examined.

Thos. C. Elder. Wm. J. Nelson.

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Attorneys at Law & Real Estate Agents,
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☞Best references furnished when desired.

Attorneys,—Virginia.

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D. & A. H. FULTZ,

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Attorneys,—West Virginia.

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Attorney-at-Law,
Charleston Kanawha County W Va

W. S. Laidley. Wm. H. Hogeman

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Dealers and Commission Merchants in

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Native and Foreign Iron, Manganese and other Ores.

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I have 1,000 tons of lump Brown Hematite Iron Ore, 51.20 per cent. metallic iron, from the Excelsior Iron Mine, now on the Chesapeake and Ohio Railway ready to ship, which I wish to sell.

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Manganese Merchant and Mineral Broker,
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SALE OF MOST VALUABLE REAL ESTATE and IRON PROPERTY.

By virtue of a decree of Nelson Circuit Court, pronounced at September term, 1880, in the chancery cause of Robinson &c. vs. Peters &c., the undersigned, as commissioners, will offer at public auction at New Market, in said Nelson county, on

Friday, May 13, 1881,

at 12 M., the real estate of Dr. Frederick J. Peters, known as "Sleepy Hollow" tract of land, about 3 miles below New Market, containing 1264½ acres. The said 1,264½ acres is a valuable mineral property, and is regarded by many as giving the strongest evidence of an unlimited quantity of iron ore, manganese, slate, marble, and copper. About 300 acres is cleared and the remainder is in original growth. It lies within one mile of the R. & A. RR. with descending grade and right of way thereto. This property is looked upon as the most valuable mineral property that has ever been offered in this section of Virginia, and all persons desiring to purchase, are invited to examine. It will be sold either in whole or in part to suit bidders.

TERMS.—Cash enough will be required to pay costs of suit and sale, and for the residue, bonds with good personal security with waiver of homestead exemption, bearing interest from day of sale, and payable within one, two, and three years.

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J. L. S. KIRBY,
RO. WHITEHEAD,
JNO. H. MCCUE,
Commissioners.

VALUABLE ZINC MINE FOR SALE.

The Falling Cliff Zinc Mine, Wythe Co., Va.,—adjoining, on the west, the celebrated Bertha Zinc Mine from which the zinc furnaces at Martin, A. M. & O. RR., are supplied,—having been fully tested by pits and shafts, during three years of explorations, is now offered for sale.

FOR TERMS, apply to D. S. Forney, Allisonia, Pulaski Co., Va., or R. M. Lawson, Alexandria, Va.

COAL AND TIMBER LANDS FOR SALE OR LEASE.

The undersigned, as President of a Land Company, has for sale or lease, on favorable terms, some of the best coal and timber lands in the New River District, on the line of the Chesapeake and Ohio Railway. The coals on these lands are the **Coking Coals**, the coke from which is now so much in demand for blast-furnace and other metallurgical uses. For further information and terms, apply to

SAMUEL COIT, President,
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As attorneys for the heirs, we offer for sale, on most reasonable terms, Lot "H" of the "Steele Survey," the Smithers-Gauley Tract, containing

6,256 Acres of the Very Best Coal Lands

in the heart of the Great Kanawha Coal-field of West Virginia. This tract is on the line of the Chesapeake & Ohio Railway and on the navigable Kanawha River where it has been improved by the United States Engineers. It has **Over 50 Feet of Coal**, including *Gas, Splint, Cannel*, and other varieties, in workable beds *above the water-level*. It is covered with excellent timber. It adjoins the lands of the noted Cannelton Coal Co. and those of C. P. Huntington, President of the Chesapeake & Ohio Railway, which are parts of the same survey. We refer to the March, 1880, No. of "The Virginias Mining Journal" for description, map and coal sections of this tract, and invite correspondence for same and for terms. Address

G. M. & W. B. HARRISON,
Staunton, Virginia.

Jas. T. McCreery, Raleigh C. H. N. M. Lowry, Hinton.

McCREERY & LOWRY,

REAL ESTATE BROKERS,

Raleigh C. H. and Hinton, W. Va.

Have for sale over 200,000 acres of timber, mineral and farming lands. Titles examined and any information in regard to the resources of West Virginia cheerfully given.

The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 4. } Staunton, Virginia, April, 1881. { Price 25 Cents.

The Virginias,

PUBLISHED MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor,

At 346 E. Main St., Staunton, Va.

Terms, including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising, per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors.), complete, with index and title page, will be sent, by express or mail, prepaid, to any address in the U. S., *on receipt of Three Dollars.*

Note on Kanawha Valley Coals.—In last paragraph of Dr. Stevenson's paper, page 55 of this number, the statement intended to be made is, that the dip of the strata below Kanawha Falls is about 30 feet to the mile.

Norfolk & Western Ry.—We proposed to have an article upon this great railway in this number, illustrated by a good map; we find, after delaying for them, that we cannot get the maps here in time for this issue, so we will give both in the May number.

The Sleepy-Hollow Iron Lands, in Nelson county, Va., that are advertised in THE VIRGINIAS to be sold on the 13th of May next, include the same ranges of specular and brown hematite iron ores of the James River Belt as do the lands of the Central Virginia Iron Co. that is now shipping so much ore. Those wishing to buy a good iron ore property would do well to attend this sale.—The Richmond & Alleghany RR. will run its cars from Richmond to near these lands by the day of sale.

Capt. C. R. Boyd, M. E., we are pleased to see, from a commendatory notice in the Wytheville *Enterprise*, has his services very much in demand for the examination of mineral properties in Southwest Va. He has recently published a colored geological map of that region, compiled from those of Rogers, Currey and Lesley, with numerous additions from his own surveys and observations; it was prepared to accompany the volume on S. W. Va., now in press, that we have heretofore favorably noticed.—Mr. Boyd presented a paper on Naval Armament at the last meeting, in Philadelphia, of the American Institute of Mining Engineers.

The Staunton, Va., Meeting of American Institute of Mining Engineers.—Since the following editorial was put in type we have been officially informed that the next meeting of the Institute will begin, in this city, Staunton, Va., on Monday evening, May 30th, 1881, for a week's session, including the "movings," as outlined, in a general way, below, subject to such modifications as circumstances may demand.

The Secretary, Dr. T. M. Drown, Lafayette College, Easton, Pa., (as good a one, we venture to say, as any society was ever blessed with), writes us, April 21st:—"The editorial article you sent me from THE VIRGINIAS sounds the key note of a most enthusiatic meeting. I think there will be a good attendance."

Mr. J. F. Lewis, of Quinnimont, W. Va , who is the local Member of the Council, has called a meeting of the Va. and W. Va. members of the Institute to assemble at Williamson, Va., Saturday P. M., April 30th, to make full arrangements for the forthcoming meeting.

The officers of the Institute for the current year are: *President*, William Metcalf, Pittsburg, Pa.; *Vice-Presidents*, J. P. Kimball, Bethlehem, Pa., W. H. Petee, Ann Arbor, Mich., C. O. Thompson, Worcester, Mass.; *Managers*, J. S. Alexander, Philadelphia, H. S. Monroe and J. C. S. Randolph, New York; *Treasurer*, Theodore D. Rand, Philadelphia, and *Secretary*, Thomas M. Drown, Easton, Pa.

In a list of recently elected members, just received, we find the following from the Virginias, in addition to those named on page 50, viz:

Water G. Berg, ... Richmond, Va.
T. Catesby Jones, ... Lynchburg, Va.
John S. Kennedy, ... Rocky Mount, Va.

The American Institute of Mining Engineers will hold its next meeting, known as the "spring" meeting, in this place, Staunton, Virginia, in the early part of next June, as the General Assembly of the Presbyterian Church meets here during the latter part of May and makes it impracticable for the Mining Engineers to meet earlier. The members of the Institute are to be congratulated that the time of coming together is somewhat later than usual—for, to see the Great Valley of Virginia in the month of June, when its clover fields are all abloom, its broad acres of harvest green-and-gold, its wide stretches of park-like forests seas of densest foliage, all undulating as a broad thirty miles wide belt, patterned in endless forms and colors, between the great mountain ranges of the Blue Ridge on the east and the Apalachians on the west, beneath the brightest of skies and bathed in the most genial of atmospheres, is to see a country of unsurpassed beauty when its charms are full blown and when all the elements conspire to make even mere existence there a delight.

The members will convene in the Staunton Opera House, for the first meeting of the session, probably on a Monday evening, when they will be welcomed by our citizens, through some one of its representative men, and hear a short illustrated paper on the Geology and Mineral Resources and the Present Condition of Mining and allied Industries in the portions of Virginia and West Virginia that will be visited during the meeting.

It is probable that among the many important papers that will be read and discussed during this meeting there will be a goodly number relating to the Virginias.—Prof. Fred. P. Dewey, Chemist to Roane Iron Co., Chattanooga, Tenn., proposes to read two on some Virginia iron ores he has been investigating. Prof. Thomas Egleston, of Columbia College School of Mines, New York, will probably read one on the copper ores of the Blue Ridge in Va. and N. C., which he has recently examined in person and of which he has made more than 40 analyses. We hope also to have at least short papers concerning geological, minerological, mining and manufacturing matters in these States, the results of their own recent work and observations from each of the Virginian members, named below, and also from Prof. Winston, of Richmond College, Dr. Ruffner, Supt. of Public Instruction in Virginia, Profs. Fontaine, Mallet and Dunnington of the University of Va., Prof. Campbell of Washington & Lee Univerity, and Prof. White of the University of W. Va. We may also expect to hear something about the Virginias from Professors Kerr, Stevenson, Kimball, Dwight and other distinguished scientists who have recently made explorations in these States. Especially do we hope that the revered and honored Prof. Wm. B. Rogers, now venerable in years but still full of the fire of his youth, may delight with his presence and words this first maeting of the Institute in the region made famous by his geological labors of nearly half a century ago.

This meeting will continue during a week, but its sessions will be varied, it is pretty well understood, by the following excursions:

(1) Over the *Shenandoah Valley RR.*, with its fine views of

the Shenandoah Valley and its bounding mountains in the light of opening day, running for a hundred miles along the iron ore outcrops and manganese beds in the Potsdam group, Rogers' No. 1, of the Lower Cambrian, and for fifty miles along the Siluro-Cambrian and Silurian (Nos. III and V) iron ores of the Massanutton mountains, visiting the famous Port Republic battle-field, the great iron ore beds of the Shenandoah Iron Works, the ochre beds of the Oxford Co., and the famous Luray Caverns, as the invited guests of the railway company.

(2) Probably returning to Staunton over the *Valley Branch of the Baltimore & Ohio RR.* and seeing the inspiring scenery of the Western Shenandoah Valley as parting day throws the shadows of the Great North mountain across its noble meadows and grain-fields, skirting again the Massanutton ore ranges, now on the east, and running along the Little North mountain with its wonderful beds of fossil and red-shale iron ore, No. V., or Clinton, as displayed at Van Buren, Columbia, and Liberty furnaces.

(3) Over the *Chesapeake & Ohio Railway*, with its wonderful views of valleys, mountains, cañons and rivers, and its chain of noted summer resorts, and running for nearly 100 miles along the outcrops of stratified beds of Clinton and Oriskany iron ores, and for another hundred in a huge natural "open cut," down entirely through the Carboniferous, with the outcrops of more than a score of workable beds of various kinds of coals exposed on either hand; making short stops at Buffalo Gap and Ferrol furnaces, longer ones at the large furnaces and ore beds at Longdale and Low Moor; looking down, for miles, upon the Peters mountain range of iron mines; spending a night and holding a session at the famous White Sulphur Springs, most delightsome of watering places; stopping briefly at Quinnimont furnace, the coal mines and coke ovens at Stone Cliff, Fire Creek, Sewell and Nutallburg; making a longer stay at Hawk's Nest, to visit the palatial coal mines of the Hawks Nest Coal Co., and look over the widely expanded Carboniferous plateau from the railway-reached Gauley mountain mines more than 1,000 ft. above the C. & O. Ry.; and thence down through the wild gorge of New river by the famed Hawks Nest cliffs, and the falls of the Great Kanawha and down the Great Kanawha river to Charleston, the capital of West Virginia, for the night. On the return, up the valley of the Kanawha, by same railway, seeing the numerous salt furnaces above Charleston, stopping at the coal mines at Coalburg and Cannelton, and going through, successively, the Middle and Lower coal measures, Nos. XIII and XII, and the Greenbrier shales and limestones, No. XI, as their horizons successively rise into view in the cañons of the Kanawha, New and Greenbrier rivers—in fact, beholding in a daylight run a grand thorough-cut section of all the geological formations, where they probably have some of their best developments, from the Upper Carboniferous down to the Archæan.

(4) From the Chesapeake & Ohio, at Williamson a trip will be taken over the *Richmond & Alleghany RR.*, passing through the grand natural geological arch at Iron-Gate (Clifton Forge), down the valley of the James, along the great outcrops of Clinton and Oriskany iron ores of Rich-patch mountain, by Callie and Roaring Run furnaces, (perhaps after going up the Callie branch of the C. & O. to see these ore beds at that furnace), by the Big-hill ore belt of the Lowry iron mines, by the Purgatory basin of Clinton and other iron ores, with a brief halt at Salisbury furnace, down to Buchanan, again in the Great Valley, thence on down the James along the Primordial iron ore belt of the Western Blue Bidge, by the Arcadia and Glenwood iron properties, by the Indian Rock limestone quarries and lime kilns, and the quarries and kilns of the James River Cement Co., passing within a mile and a half of and perhaps visiting the famous Natural Bridge of Virginia, and on to Balcony Falls, where the James breaks through the Blue Ridge and exposes one of the grandest sections of the Lower Cambrian and Archean rocks on the continent.

(5) We hope time may be found for a visit to the University of Virginia, one we are sure the members would greatly enjoy.

We are confident that our people, Virginians all whether native or adopted, will see to it that nothing is wanting to make this the most enjoyable, instructive and rememberable meeting that the American Institute of Mining Engineers has ever held. The local members are now consulting as to "ways and means," and an inspection of the list will show that they are men whose promises mean things done. The proverbial hospitality of these states will be dispensed wherever opportunity and occasion will permit, and in their name we ask for the largest possible attendance, not only of members and their wives and daughters, but of others that would see our large mineral and other resources, and the development of them that is now being made, and hear about them under exceptionally favorable circumstances.

The American Institute of Mining Engineers was organized in 1873; it now numbers nearly 900 members, among whom are most of the leading mining engineers, geologists, chemists, metallurgist, etc., of North America. Its volumes of "Transactions," eight bulky ones of which have been published, are second to none that are now issued in the number and value of their scientific, metallurgic, mining, and other contributions. The *School of Mines Quarterly*, of New York, in its last issue, says: "Its meetings are among the most important professional events of the year, and it may well be ranked among the foremost educational institutions of the country—a professional school with distinguished engineers as students, and specialists as their instructors! An attendance at the meetings will richly profit any student of engineering—for not only the subjects of the papers, but engineering progress in general finds its way into the discussions. Not merely theories, but actual practical facts. The papers themselves are rarely read entire, but the author in a brief, pithy summary, often more interesting and intelligible than the paper itself, gives an outline of his experience or investigations, and the conclusions derived therefrom. The cut-and-dried printed reports of the discussions give but an imperfect idea of the pleasure and profit of the meetings."

"*The objects of the American Institute of Mining Engineers* are to promote the Arts and Sciences connected with the economical production of the useful minerals and metals, and the welfare of those employed in these industries, by means of meetings for social intercourse, and the reading and discussion of professional papers, and to circulate, by means of publications among its members and associates, the information thus obtained."

The Virginia members of this Institute, alphabetically arranged, are the following:

C. R. Boyd,	Wytheville, Va.
Geo. W. Bramwell,	Stone Cliff, W. Va.
Stuart M. Buck,	Coalburg, W. Va.
H. Firmstone,	Longdale, W. Va.
Frank J. Hearne,	Wheeling, W. Va.
Jed. Hotchkiss,	Staunton, Va.
E. S. Hutchinson,	Cannelton, W. Va.
J. E. Johnson,	Longdale, Va.
James F. Lewis,	Quinnimont, W. Va.
Orleans Longacre,	Irontown, W. Va.
M. F. Maury,	Saltpetre Cave, Va.
S. Fisher Morris,	Quinnimont, W. Va.
Charles J. Nourse,	Casanova, Va.
Earl W. Oglebay,	Wheeling, W. Va.
William N. Page,	Ansted, W. Va.
C. A. Rundall,	Ferrol Va.
Geo. T. Wickes,	Lowmoor, Va.

In our next issue we shall give the exact time of the meeting and the arrangements and dates for sessions, excursions, etc.—It is also our purpose to embody in our next number a large amount of geological, mining and manufacturing information in reference to the portions of these states that will be visited by the Institute, illustrated by maps, sections, etc.; making it THE VIRGINIAS MINING JOURNAL special number for presentation to the members at the Virginia meeting of the American Institute of Mining Engineers.

Facts Worth Thinking About.

Written for THE VIRGINIAS.

By HON. A. H. H. STUART.

In a few months the extension of the Chesapeake & Ohio Ry. eastward, from Richmond to Newports-News, on the Chesapeake bay, and westward, from Huntington to Lexington Ky., where it will connect with whole system of the western railroads, will be completed. When finished this will be the best and safest line of communication between the east and the west, because the grades are much easier than on either of the rival lines south of New York, and the mildness of the climate of the country through which it passes, and the consequent comparative exemption from obstruction by snow and ice, during the winter and spring, give it great advantages over all its more northern competitors.—This great national thoroughfare from east to west is located through the heart of Augusta county.

The Valley Railroad, from Staunton to Harpers Ferry, and the Shenandoah Valley RR., from Waynesboro to Hagerstown, Maryland, now give us connection with the whole system of northern railroads, reaching, in a northeastwardly direction, to Canada, and northwestwardly, to the Great Lakes.

The Valley road and the Shenandoah Valley road, in their present incomplete condition, are merely local roads, and have no significance from a national point of view. But their geographical position, and the general topography of the Valley, make them important, we had almost said indispensable, links, in a great chain of railways from north to south. The keen intelligence of Mr. Thomas Scott, President of the Pennsylvania RR., enabled him, at a glance, to perceive and appreciate the importance of incorporating these detached links into the general system of intercommunication between the north and the south. With this view, having obtained the necessary legislation, he has, through the agency of the Shenandoah Valley RR. Co., taken measures to extend, during the coming season, the road of that company to a point at or near Salem, where it will connect with the Norfolk & Western Railway (Atlantic, Miss. & Ohio). To ensure harmony and concert of action with that road, Mr. Scott has bought the Norfolk & Western Railway, at a cost of about eight and half millions of dollars. When this extension of the Shenandoah Valley RR. shall have been completed, and brought into connection and harmonious co-operation with the Norfolk & Western road, instead of being as it now is, a mere local road, it will be converted into a central link in the great chain of continental railways from the north to the south.

This prompt, energetic and sagacious action, on the part of Mr. Scott, has opened the eyes of the Baltimore & Ohio RR. Co., which now controls the Valley road from Staunton to Harpers Ferry, and put a coal of fire on its back. It seems now to be pretty well settled that, within a few weeks, contracts will be made for the extension of the Valley road from Staunton to Lexington, Va., where it will form a connection with the projected extension of the line of Mr. Scott's Shenandoah Valley RR. to Salem, and thus be brought into connection with the southern system of railroads. The effect of the extension of these two roads will be to give us two great northern and southern lines, passing through Augusta county, one through Staunton and the other through or near Waynesboro.

Thus, it will be seen, that before the close of the present year, Augusta county will become a great railroad centre, as the intersections of two great northern and southern lines of communication with the grand trunk line from east to west, will take place at Staunton and Waynesboro.

Who can estimate the advantages which are likely to accrue to Augusta county, from the fact that the intersections of these great continental highways between the north and south, with the great line from east to west, take place within her bounds?

We have already expressed the opinion (and given the reasons on which it is founded) that the Chesapeake & Ohio Ry. possesses advantages over all other roads reaching from east to west.

We think we have equal warrant for affirming that the routes through the Valley of Virginia, from north to south, will be found to possess decided advantages over any others. Among the reasons which have led our mind to that conclusion are the following:

These roads run through a fertile and picturesque country, which is entirely free from malaria, being west of the Blue Ridge, on a plane several hundred feet higher than the country east of that Ridge. The soil on which they are located is firm and solid, and limestone for masonry and ballast is to be found in close proximity to the roads all along the lines. The firmness of the soil gives stability to the road-bed, and the abundance and convenience of limestone renders it practicable, at small cost, to ballast thoroughly and keep in repair the tracks and thus fit them for the safe and rapid transportation of freight and passengers.

An eminent railroad man, some years ago, informed the writer of this paper, that in view of the porous and spongy character of the soil of some portions of eastern Virginia, and the difficulty of obtaining, at reasonable cost, the quantity of stone necessary to ballast roads in that section, it was almost impossible to fit them for high rates of speed. By way of illustrating his proposition he stated that in very wet seasons, and especially in the spring of the year, when the frost was leaving the ground, it would be safer to run at the rate of 40 miles per hour over a well ballasted road in the Valley, than at 20 miles over the Midland road.

Nature seems to have ordained that the Valley of Virginia should furnish the best route for intercommunication between the north and south. While the rivers of other portions of the state run either in an easterly or westerly direction, the course of the Shenandoah is almost from south to north, thus opening a natural track for a great highway north and south unobstructed by mountains along its course. And the indentations of the coast by the Chesapeake bay and Potomac river on the east, and the mountains of Maryland and West Virginia on the west, seem to compress the district of country suitable for the construction of a great national highway, within very narrow limits. More than 50 years ago—before railroads had been invented—a proposition was introduced into Congress for the construction of a great national turnpike from Buffalo, on the northern frontier, to New Orleans, which was then near our southern boundary. A survey was made which showed that the route through the Valley of Virginia was the most eligible.

So when Baltimore was about to commence her great railway, half a century ago, she sought earnestly, but in vain, to get permission to construct it through the Valley of Virginia, from Harpers Ferry to Bristol, thus indicating the opinion of her sagacious merchants, that the Valley presented the best route to the south. Such was the anxiety of the people of Baltimore to secure the right of way through the Valley that they offered to pay to the State of Virginia, as a bonus for the privilege, fifty cents for every passenger who sought travel on the road. Unfortunately, through the jealousy of the friends of the James River Canal Co., the application was refused. If wise counsels had prevailed the Valley would now be teeming with population, wealth and prosperity.

Fortunately the day of narrow local prejudices has passed away, and we are now about to enter on the career of progress which ought to have commenced half a century ago, but which we believe will now advance with accelerated speed.

The most sanguine can hardly conjecture what great things the future has in store for us. Slavery, the great bug-bear that frightened off northern capital and enterprise, has now ceased to exist, and we already see a new era dawning upon the south. The southern states now present the most attractive field for immigration and the investment of capital. New railroads are constantly being projected and constructed. Manufactures are springing up in all quarters. Our mines are being explored and new sources of prosperity being opened. Not satisfied with developing the resources of our own vast territory, we are seeking to command the trade and minister to the prosperity of our sister republic of Mexico. At an early day a railroad will be completed to the Rio Grande, our southern boundary, and it is stated that arrangements have been made for its extension, by means, mainly, of American capital, thence southward nearly 1,000 miles to the city of Mexico. And finally, we learn from the newspapers, that Gen. Grant, under the auspices of northern capitalists, is now

in Mexico, with a view to perfect arrangements, for the extension of the line of railway nearly 1,000 miles, still further south, from the city of Mexico to Tehuantepec, a town situated on the western coast of the isthmus of the same name.

It almost makes one's head dizzy to contemplate the splendor and grandeur of the enterprises which have been set on foot, and are destined to be accomplished in the near future, by American genius, American capital and American energy.

And yet we find foolish people croaking about the dullness of the times, and the want of employment for the labor of the people.

Away with all such nonsense! Let all be of good cheer, especially in Virginia, for never since the settlement of our country were our prospects so bright!

The Hawks-nest Coal Co., (limited),—Wm. N. Page, M. E., superintendent; office at Ansted, Fayette County, W. Va.; mines on Gauley mountain, connected with the C. & O. Ry. by branch to Hawks-Nest station,—mined, during the year 1880, 49,438 tons of coal. The mines were comparatively idle from April to October, the shipments between those months having been less than for Nov. or Dec. Most of the output went to Portland, Maine, by way of New York, where it competes, successfully, with Cumberland and Clearfield coals for steam purposes. The Virginia consumers of this coal were the Chesapeake & Ohio, the Va. Midland, and the Richmond, Fred'g and Potomac railroads. The average number of miners employed was 45, and of outside men 30, a total of 75. Some 300 tons of coke were made from "slack," in two trial ovens erected near Hawks-Nest station; this was sold to Grace furnace at Ferrol, Va., and to Lynchburg, Va., iron works.

The 11-ft bed of coal worked by this Co., on Gauley mountain, started with 4 partings, none averaging over 8″ thick, though the middle one, in places, reached 18″ of sandstone, but that disappeared as the workings got under the mountain. At this time in the 3 parallel entries that have been driven for 1,500′, the whole 11-ft. bed shows but two "partings," both slate, one of 3″, two ft. from the top of the bed, and one of 1″ a foot above the bottom of the bed. The entry driven farthest under the mountain shows but one parting.

S. H. C., the ever-welcome special correspondent of the *Pittsburg Telegraph*, under date of April 12th, writes of these mines:

"Work here continues good. The mines are running out all the coal they can get cars to transport, giving their miners pretty steady work. Mr. Page, the superintendent is arranging for the building of 100 coke ovens during this spring. They have built a couple of ovens and tested their coal and find that it makes a very good grade of coke. Two large blast-furnaces are to be built by this Co., near Goshen, Rockbridge county, Va., for which they will manufacture the coke here. The prospects for the extension of the mines here during the year are very flattering. They have a good vein of coal from which they mine between 7 and 8 feet and leave about 3 feet in the bottom. The miners receive 40 cents per ton for the run of mine, and get steady work the year round. They are at present employing about 75 men. The mines are located away up in the mountain, about 4 miles from their chutes,and will be remembered by many miners in your neighborhood as the one at which the Co-operative Co. of miners made such a disastrous failure a few years ago."

The output of the Gauley Mountain mine for the first quarter of 1881, i. e. for Jan., Feb. and Mar., was 14,969 tons; of this quantity 5,482 tons were sent over the company's narrow-guage railroad in 21 days of March, (on one day 374 tons) all the hauling having been done by "Little Bet" engine in charge of a boy engineer, by the name of Miller, about 12 years old, with another boy of about the same age as fireman.—Mr. Page says he could, on short notice, deliver 1,000 tons of coal a day to the Chesapeake & Ohio Ry. if that road would furnish cars to take it from his tipple.

Native labor is largely used at these mines, that of the young white men raised in the vicinity. The superintendent informed us that it was abundant, and in his opinion as good as any the world could furnish. As an evidence its of character and thrift we may mention that two of these young men have received in cash, at the end of each month, of the last 18 never less than $100 apiece, as wages for mining coal by the ton, and that in the mean time they have bought and paid some $2,000 for a farm and have nearly another $1,000 in cash on hand.—We desire to call the attention of our strong young men, who are so frequently drifting westward to "take their chances," to the sure and good rewards that honest labor can now find in healthy occupations, at the rapidly developing mines and iron works of our Virginia states. The world nowhere offers better inducements for the industrious, all things considered, than are now offered here.

The Coal and Coke Movement, from the mines, over the Chesapeake and Ohio R'y, for the month of March, 1881, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Mr. Charles M. Gibson, the Fuel Agent for the Company, were as follows:

	1880.	1881.
Fuel for use of Company	10,653	11,019
Shipped at Huntington on the Ohio river	13,011	17,268
Delivered on line of Elizabethtown, Lex'n & Big Sandy RR.	....	3,130
" " Chesapeake & Ohio R'y. west of Richmond	2,933	8,243
" at Williamson to Richmond & Alleghany Railroad.	....	99
" Staunton to Balt. & Ohio Railroad, Valley Division	....	....
" Waynesboro to Shenandoah Valley Railroad	....	40
" Charlottesville to Va. Midland R'y	4,345	4,805
" Gordonsville to do. do.	38	80
" Hanover Junction to R. F. & P. Railroad	1,276	860
" Richmond for consumption, including steam-tugs and dredges	3,764	7,439
Shipped at James River wharves	11,505	18,312
" Newport-News wharves	....	....
Total	47,525	71,245

The increase of 23,720 tons in the total movement in March, 1881, over that in March, 1880, was one of 50 per cent. The shipments at James River wharves show the largest increase; it being over 59 per cent.

The character of the fuel moved during the same periods, is shown in the following exhibit:

	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Total.
For the month of Mar., 1881,	634	22,628	14,158	26,673	7,152	71,245
" " " 1880,	2,132		41,194		4,199	47,525
Increase, 1881	.....		22,265		2,953	23,720
Decrease, "	1,498		.....		.....	.....

In the "New River and other steam coals" is included the product of the Eagle, and Gauley Mountain mines.

The fuel movement for the months of Jan., Feb., and March—the first quarter, of 1881, and for the corresponding quarter of 1880 was as follows:

From January 1st, to	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Total.
March 31st, 1881,	1,481	56,611	40,006	64,094	16,950	179,142
Same period, 1880,	7,558		111,697		7,946	127,201
Increase, 1881,	.....		49,014		9,004	51,941
Decrease, "	6,077		.....		.....	.....

The increase in the first quarter of 1881 was more than 40 per cent in the total movement, over 43 per cent in that of other coals than cannel, and more than 113 per cent in that of coke, notwithstanding the interruptions caused by the unusual weather of 1881.—The increase in coke traffic is due to the large demands of Virginia blast-furnaces, and that increase would be doubled if the Low Moor consumption appeared in the returns as coke and not as New River coal as it now does.

Timber for mines is made more durable by a French method by which the lumber is piled up in a tank and covered by a layer of quicklime which is gradually slaked with water. In a week, or less, it becomes saturated and then it will not rot. Beech prepared in this way is said to become as hard as oak.

The Iron and Steel Association of Virginia, Limited.

In a former number we stated that the old California furnace property, in Bratton-run valley, Rockbridge county, Va., near the line of the Chesapeake & Ohio Ry, had been purchased for an English Company by Mr. Wm. N. Page, C. & M. Eng., the superintendent of the Gauley-Mountain mine of the Hawks-Nest Coal Co., Limited, of W. Va., also an English Company, from Echols, Bell & Catlett, of Staunton, Va., agents of the owners. We are now authorized to state that a company, known as the *Iron and Steel Association of Virginia, Limited*, embracing men of large means and high social position in England, has been organized in London, with Major D. P. Peploe, of 22 Hall St., Mayfair, London, as chairman, and Mr. W. N. Page, of Hawks-nest, W. Va., as financial manager, and become the owners of this now unimproved California furnace property, some 8,000 acres in extent, with its immense beds of iron ores, limestones and sandstones, extensive forests and sites for manufacturing establishments and villages, for a very moderate sum compared with its very great value as an iron producing estate.

As its name intimates this company proposes to manufacture both iron and steel, and, we may add, to engage in what may be called iron-works generally. An amount of capital, ample for all proposed operations, has already been paid in. Manager Page is now having the land surveyed, and by the first of next month he will begin the construction of 7.5 miles of standard-gauge railway from the Chesapeake & Ohio, at Goshen—168 miles by the railway, west from Richmond and 156 miles east from Hawks-nest—southwest, up Bratton run, to the site of the old Mt. Hope and California furnaces, the place wisely selected for the new works. At the same time work will be begun on some 3 miles of narrow-gauge railroad and branches from the furnace site to the iron ore beds and limestone quarries still further up Bratton run, and on two blast-furnaces, each of 150 tons capacity, one of which will be completed and put in blast as soon as possible and the other so that it can be completed, when desired, in a short time. The plans for these furnaces have been made in England and are now on their way hither, in charge of Mr. Shepherd, the engineer that superintended the construction of Low Moor, Va., furnace; they are still, very properly, subject to the approval of Manager Page. The immediate expenditure of the Iron and Steel Works Association of Va., will be about $600,000, but, as before stated, capital is already provided for any enlargement or extension of operations that it may be deemed advisable or profitable to make.—The London office of this company is 19 Queen Victoria Street.

This will make the sixth active iron-works in the 50 miles of the North Mountains iron-belt along the Chesapeake & Ohio from Buffalo Gap to the southwest.—Buffalo Gap furnace, Grace at Ferrol, this I. & S. Association of Va., the two furnaces at Longdale, and the Callie, and Low Moor, and the prospect is good for active operations very soon on the Guy run estate, adjoining that of this new company, and at Cook's and on Alleghany Iron Co., and on Roaring-run properties, near Callie and Low Moor, in the same belt,—mining is now done at Preston and Wilson, and at Lowry mines of same range.

The Hawks-nest Coal Co., of which Mr. Page is and will remain superintendent, has undertaken to supply the fuel for the furnace on Bratton run, and to that end it will at once erect 100 Coppee coke ovens at Hawks-nest station, to make coke from its 11-ft bed of coal, so as to be ready to meet the demands of the Va. Iron and Steel Ass'n.

It was a high but well-merited compliment to Mr. Page (one we are pleased to say of our numerous talented, energetic and successful Virginia mining engineers), that it was made a condition, in England, precedent to the organization of the Iron and Steel Association, that the Hawks-nest Coal Co. should allow him to be the financial agent or business manager of the new company.

In the "Iron Manufacturer's Guide," by J. P. Lesley, Secretary of the American Iron Association, (now the State Geologist of Pa.), published in 1866, but now out of print, we find the following in reference to the two furnaces that were formerly on this property.—(1) "*California Steam and Water Hot-blast Charcoal Furnace*, owned by John W. Jordan, Alum Springs P. O., Rockbridge county, Va., standing on Bratton's Run, 15 miles west of north from Lexington, 2 miles southeast of the Springs, was built in 1850, 9 ft. across the bosh by 36 ft. high, and made in 18 weeks of 1855, 1,076.5 tons of cold short metal out of brown hematite ore from banks 2.5 miles distant to west of south."—(2) "*Mount Hope Charcoal Furnace*, situated a quarter of a mile above California Furnace, on the same stream, was built about 1849 (by Doyle.-Ed.), abandoned in 1853, and is not much dilapidated."

Bratton-Run valley is one of the narrow northeast-south west trending ones of the Apalachian region of Va., bounded by barrow-like parallel mountain ranges; its extreme length, from the head of the run to its mouth in Big Calf-pasture river of North river of the James, is 10.5 miles, and its breadth, from top of Mill mountain on the northwest to top of North mountain and its extension as Bratton mountain on the southeast is from 3 to 6 miles; an intermediate range, Brushy mountain, parallel with and like the others, divides 4.5 miles of the length of the upper portion of the valley into two valleys, each about 1.5 miles wide from mountain top to mountain top; the westerly one watered by Alum-springs branch and the easterly by upper Bratton run proper, the two branches unite just below the site of California furnace; the area of the Bratton-run drainage-basin is about 25 square miles.

The estate purchased by this Association, embracing some 8,000 acres of valley-and-mountain land, was made up some years ago by combining the California and Mount-Hope furnace properties. It includes about 7 miles of the length of the upper portion of the Bratton-run valley, that which embraces the two forks of the run and Brushy mountain between them, but within it are the property of the Rockbridge Alum Springs, an exceedingly well-improved and highly esteemed summer resort, and a few small private holdings.

Geologically, the upper portion of the Bratton-run basin is a central anticline, Brushy ridge, in the backbone of which are exposed the rocks of No. IV, Medina, and V, Clinton, etc., flanked on each side by VI, Lower Helderberg, VII, Oriskany, and VIII, Marcellus, etc., with synclinal valleys, those of Alum-springs branch and upper Bratton run on each side, their surfaces of No. VIII under-run by the VII, VI, V, IV, etc., forming Brushy ridge, depressed probably in a somewhat flattened trough, which rise again and outcrop, as in Brushy ridge, on the slopes of the anticlinal or upward-arched ranges of Mill and North mountains. The valley synclines and Brushy mountain anticline probably become confused in a wrinkled mass in the divide between Bratton run and Simpson creek. The structure of the lower valley is not as sharply defined, but it is most likely that of the Alum-Springs valley prolonged as a wider syncline.—It follows from the the above that, through time's changes, all the formations from II or III to VIII, Cambrian, Silurian and Devonian ones, outcrop, most of them several times, in N. E.-S. W. lines through the length of this estate, making it an easy matter to get access to their interstratified mineral beds.

The Virginia iron-ore bearing formations here exposed are the Hudson River, No. III, the Clinton No. V, and the Oriskany No. VII; the first and second have not been explored here and what the local conditions of their ore-beds are we do not know. The great ore-bearing strata of No. VII have here a very large development, and from them quantities of iron ore have been taken during the last 30 years. These ore beds, many feet thick, outcrop, in spur-and-hollow lines all along both flanks of Brushy ridge and on the eastern flank of Mill mountain and the western one of North mountain and its topograpical extension, revealing in knobby natural projections and in imperfect workings great quantities of iron ore, average samples of which, from the S. E. side of Brushy mountain lately gave, in analyses by Prof. J. L. Campbell, 53.64 per cent of metallic iron with 1.50 per cent of insoluble matter, mostly silica; and average samples from the N. W. slope of North mountain gave 44.50 per cent of metallic iron with 23.90 per cent of insoluble matter, mostly clay.

Formation No. VI, the Lower Helderberg, is a limestone, proven of excellent quality for furnace flux both here and at Longdale and elsewhere; it outcrops on Mill and North mountains and can be had by drifting on Brushy mountain. Formations IV and V have heavy beds of sand-rock suitable for building purposes. The aluminous shales of VIII might be utilized in the manufacture of alum.—Editor.

Note on the Coals of the Kanawha Valley, West Virginia.

By Jno. J. Stevenson, Ph. D.

Note.—The following paper, which we reproduce from Annals of Lyceum of Natural History, Salem, Mass., was read to that society Feb. 17th, 1873. It is a very valuable contribution to our knowledge of the great Kanawha coal-field, and will be read with interest by our numerous readers in that region, which has been very considerably developed since it was written, and had its facilities for reaching markets greatly increased by the extensions and connections made by the Chesapeake & Ohio Ry., and by the U. S. Improvement of the Great Kanawha. Its coals, unsurpassed in quantity and quality by any other region in the Union, are now becoming very important fuel and gas factors in both the eastern and the western markets.

Will not some of our "knowing" coal men give us information, derived from observation during the development of the last 8 years, concerning some of the doubtful points made by Prof. Stevenson?—We have inserted in this paper, in parentheses, Rogers' formation numbers, to localize more thoroughly the statements made.—Editor.

Along the Great Kanawha river the Upper Coal Group (Rogers' Formation No. XV,) is observable up to about 12 miles below Charleston. It contains two coal beds of workable thickness. The lower one is the *Pittsburg* (VIII of Ohio section) and is usually known as the "Raymond City seam." It is much reduced in thickness where it crosses Pocatalico creek and is very inferior in quality to the same bed in its northern extension. The limestone overlying this coal in northern Ohio and Pennsylvania as well as in the northern part of West Virginia, is here greatly degraded, being represented by only a calcareous shale containing a few nodules of limestone. The upper bed of coal is occasionally of workable thickness, but is of no economical importance. When the section has been completed, this coal will probably be proved identical with the one given in Dr. Hildreth's section at Pomeroy, which is No. X of the Ohio section, and likely the equivalent of the *Uniontown* coal of Pennsylvania.

The Lower Barren Group (Rogers' No. XIV,) reaches to Charleston and runs out in the hills a short distance above the city. It is about 500 feet thick and contains, as far as I am informed, no workable coals. It is interesting to note that along a rudely north and south line, beginning at Pittsburg and running to the Great Kanawha, the Lower Barren Group varies but little in thickness.

The Lower Coal Group sinks under the river a short distance below Charleston. Its development there, as compared with that observed in the coal-field farther to the north, is extraordinary. In northern West Virginia the thickness is barely 200 ft.; in the First Geological District of Ohio, it rarely exceeds 300 ft., while in either case it contains only 6 or 7 coal beds. In this valley it is readily separable into two portions, the upper of which (Rogers' No. XIII) is exposed along the river from Charleston to Kanawha Falls, a distance of 35 miles. Including the Mahoning sandstone, it is not less than 900 ft. thick, and contains at least 15 beds of coal, each of which is of workable thickness at different localities. The lower division (Rogers' No. XII) is exposed above Kanawha Falls to Sewell mountain, a distance of certainly 30 miles in a straight line. It contains only 2 or 3 beds of coal that are anywhere of workable size and is made up chiefly of massive sandstones, with rarely a thin shale or limestone. The estimation of its thickness is attended with some difficulty, as the dip is undulating, and there may be one or two broad anticlinals. There is no reason to believe, however, that it is any thinner than the upper division. We have here, then, a total thickness of not less than 1,800 ft., with about 20 coal seams, most of them workable at some point. The extraordinary development of this group continues southwesterly, until its thickness becomes about 2,500 ft. in Tennessee. A careful survey of the State of West Virginia would doubtless reveal some very important facts in this connection, and would aid in solving some perplexing problems arising from this variation.

The Mahoning sandstone is conspicuous in the river hills above Charleston, and, as in its northern extension in this state and Pennsylvania, holds about midway a coal which frequently becomes of available thickness. It rests upon a variable bed of "black flint," 5 to 12 ft. thick, which is occasionally associated with a thin seam of cannel.

A few feet below the flint, and separated from it by shale, often arenaceous, is a coal partly cannel and partly bituminous. At Cannelton it is 5 ft. 4 inches thick, and on Paint creek, near Coalburg, it is 7 ft. This is usually regarded as identical with the *Upper Freeport* of Pennsylvania (VI of Ohio). Aside from its position, one finds in its deportment evidence of this identity, since, wherever I have observed it in West Virginia, it shows a decided tendency to become partly cannel. Though I have not visited Peytona, yet an examination of the map, and the fact that Coal river heads near that locality and so cannot have cut very deeply into the country, seem to render it probable that this coal, known locally as the "Stockton seam," is the same with the cannel there worked. It seems hardly possible that the "Gas coal," situated 550 ft. below the "Stockton" at Cannelton, can be available at Peytona.

At Cannelton a 5 ft. coal is seen a few feet below the last, but at Coalburg it is absent, or is represented by two small seams occupying about the same relative position. Mr. Ridgway identifies this with the *Lower Freeport* of Pennsylvania. That is an exceedingly variable bed and cannot be traced satisfactorily in southwestern Pennsylvania or northern West Virginia. The whole of the state lying between the Baltimore & Ohio RR. and the Great Kanawha river, is as yet unexplored. Under such circumstances it is doubtful whether one is justified in making the determination solely upon the ground of relative position, this being, at best, an unsafe guide.

At Cannelton, the second seam below the "Stockton," is a cannel of insignificant thickness. At Coalburg, however, this place is occupied by the "Great Splint Coal," which in some respects is the most important bed along the river, although its importance is probably local. At the Kanawha Salines no such bed appears, but where it should be, there occur several thin beds considerably separated. On Paint and Cabin creeks its thickness is not far from 11 ft. and on Campbells creek, if Mr. Ridgway's identification be accurate, is is 6 ft. At Coalburg it has been worked extensively for several years by the Kanawha & Ohio Co., under the superintendence of Mr. W. H. Edwards, so favorably known to the scientific world by means of his beautiful work on the *Butterflies of North America*. At the mines of this company the bed exhibits the following section:

No. 1.	Sandstone, ...	
" 2.	Clay shale, ...	1 inch.
" 3.	*Coal*, ...	6 inches.
" 4.	Dark slate, ...	4 to 7 inches.
" 5.	*Coal*, ...	3 feet 2 inches.
" 6.	Clay, ...	3 to 5 inches.
" 7.	Coal, ...	1 foot 6 inches.

The roof is very irregular. Not unfrequently a huge clay "hip" comes down two or three feet, crossing the entries in a rudely northeast and southwest direction, and having a width of from 5 to 20 feet. Such "hips" are not always of clay but are sometimes an odd mixture of sandstone and coal, the latter included not as layers, but as fragments, as if it had been cut out after consolidation, though in several instances the bowl-shape of these fragments leads to the belief that it may have been removed before consolidation. These "hips," when traced across different entries are seen to taper off at each end.

The thin layer of clay ordinarily interposing between the sandstone and the coal contains numerous impressions of *Lepidodendron* and *Sigillaria*, but usually in poor preservation. Some years ago a series of remarkably fine leaf-scars of *Bothrodendron* were found in entry No. I of the company's works. Of these, several were sent to the Smithsonian Institution and to Mr. Lesquereux. The rest were retained by Mr. Edwards, but were lost during the destruction of his house by fire, a year ago.

The dark slate, No. 4, is rich in bitumen, breaks with a semi-conchoidal fracture, but does not burn readily and is regarded as detrimental to the coal. The *coal*, No. 5, is the most important portion of the seam, and with No. 3, affords the remarkable coal, which is sold in Cincinnati as Kanawha semi-cannel. When first shipped, the proprietors named it "Splint," simply to distinguish it, and without reference to the British signification of the term. This name was after-

ward applied to all the open-burning coals of the Kanawha valley. The coal is clean, breaks with a neat, sharp fracture, bears transportation well and contains no appreciable quantity of sulphur. It is made up of thin alternating layers of cannel and bituminous coal, for the most part not more than one-twelfth of an inch thick, though occasionally a layer of cannel occurs one or two inches. It is consequently dry and open-burning, with no tendency to cake upon the fire. The "slack" yields a coke of only slight density. Owing to the open-burning character as well as to the freedom from sulphur, this coal is destined to become of very great economical importance. Experiments have been made with it in the iron furnaces of southwestern Ohio, and in each case it has proved to be of the best quality. Owing to the uncertain outlet afforded by the Kanawha river, little has been done with this coal, but now that the Chesapeake & Ohio Ry. has been completed, the operators in the Kanawha valley will be able to forward a steady supply, so that its introduction into southeastern Ohio for use in iron smelting is a matter of a comparatively short time.

No. 7 is variable in thickness and contains more bituminous coal than the preceding. It is of excellent quality but is too brittle to bear transportation. The larger proportion of bituminous matter led to the belief that it could be coked, but experiments in this direction have not been successful.

The clay parting, No. 6, is of uncertain thickness. At the mines of the Kanawha & Ohio Co., it is seldom more than 4 inches, but followed westward it rapidly increases, so that at the western boundary of the company's property it is 2 ft. A similar increase, though by no means so great, is observable in the upper parting, so that, as far as one may judge with the imperfect exposures presented, there is much reason to believe that the thin coals at Kanawha Salines, occupying the position of this bed, are nothing other than its subordinate *coals*, 3, 5 and 7, separated by the partings, 4 and 6, greatly increased in thickness.

About 40 ft. below this coal is found a seam of cannel, nearly 3 ft. thick, well exposed at Cannelton, Paint creek, and on both sides of the river at Coalburg. It is of good quality and will probably prove of much value.

Five hundred and fifty feet below the "Stockton" coal at Cannelton, there is a bed of bituminous coal nearly 7 ft. thick and known as the "Gas coal." This is seen at Coalburg and has been worked opposite that village on the northeast bank of the river. Its thickness there is inconsiderable, barely 3 ft., and its quality poor. At Cannelton Mr. Ridgway observed a limestone below this coal, which he identifies with the *Ferriferous* of Pennsylvania. This is not exposed at or opposite Coalburg and I did not observe it at Cannelton. If Mr. Ridgway be accurate in his determination of the limestone, the "Gas coal" is very probably the *Kittanning* of Pennsylvania (No. IV of the Ohio section). In this case the persistent seam a short distance below the limestone is the equivalent of the Ohio No. III.

The coals below these belong to the lower division of the group, which I had no opportunity to examine. They are said to be well exposed in the gorge of New river.

The dip of the strata below the Falls of Kanawha to Charleston, is somewhat less than 30′, but below Charleston they are horizontal, or at least the dip is unappreciable. Above the Falls it is very undulating and one may expect to find one or more broad anticlinals between the Falls and Big Sewell mountain.

Chesapeake & Ohio Ry. Directory.—Agents are now engaged in gathering information concerning all the important manufacturing establishments, business enterprises, schools, colleges, mineral springs, etc.; the addresses of principal farmers and other men of affairs; the agricultural, mineral, and other resources, etc., of all the country tributary to the Chesapeake & Ohio Ry. from its Newports-news ocean terminus to Huntington on the Ohio, and thence to Cincinnati, for a Chesapeake & Ohio Railway Directory, to be issued by June 1st, 1881, for circulation in this country and in Europe to induce immigration to the region described. This is a praise-worthy undertaking, and one that will do much good if the work is properly edited; but it must be much more carefully done than such directory work has of late been done in Virginia, for the latest and most pretentious "Virginia Directory" is, throughout, a tissue of blunders. We hope better things of the one proposed.

Coal Mining in W. Va. in 10th Census Year.

Barbour County, W. Va., lying south of Taylor county, through which the Baltimore & Ohio RR. passes, is entirely within the Great Ohio Coal Basin. Philippi is its county-town. Tygarts-Valley river runs through the county, centrally, from south to north, and receives within it, as tributaries, Middle fork and Buckhannon rivers. The "Pittsburg" coal bed of the Upper measures (Form. No. XV) outcrops, in an eastward curve, for 16 miles,—12 of the distance in the banks of the stream-valley of Buckhannon river and its prolongation in Tygarts-Valley river to past Philippi. In this county, during the 10th Census year 60 small coal mines were worked, for local use, ranging in production from 150 to 4,000 bushels, the most productive being that of Lewis Wilson, and, next in order of production, those operated by Alex. Smith, J. Jackson, J. Richards, and J. Woodford; all near Philippi. The total production of the county was about 109,000 bushels, of 70 lbs. each, (as the "big way" of the West puts it,) or 3,815 tons of 2,000 lbs.,—the total consumption of a county largely forest covered as yet, with 11,870 people.

The coal mined is all classed as semi-bituminous. All the mines in Philippi district, 20 in number, are in a 5-ft. bed; the 8 in Cove district, N. E. part of county, along Laurel hill, are also in a 5-ft. bed. In Calhoun district, S. of Philippi, 11 mines, and in Peel-Tree district, the western of the county, 8 mines, all those of both districts, are in a 6-ft. bed. The 6 mines in Corinth district, an eastern one bordered by Laurel hill, are in a 7-ft. bed. The 7 mines in Wilmoth district, the southern of the country, are in a 9-ft. bed.

These facts *from the mines* show that in this county—one of those on the line of the proposed Pittsburg Southern RR.—four distinct beds of coal, 5, 6, 7 and 9 ft. thick, respectively, are now worked.—Will not Prof. I. C. White, of the University of West Virginia, who is an authority on the northern part of the Great Ohio Coal Basin, as the four published volumes of his reports ("Q-s") of the Second Geological Survey of Pa., attest, tell us where these Barbour county beds and also those of Upshur and Braxton, belong in the Carboniferous section?

Upshur County, W. Va., of which Buckhannon is county-town, lies south of Barbour, embraces head waters of Buckhannon and Middle forks of Monongalia and Little Kanawha rivers; it is entirely within the Great Ohio Coal Basin and is crossed diagonally, N. E.-S. W., with an eastward curve, for 16 miles, by the eastern outcrop of the "Pittsburg" coal bed. During the 10th Census year some 49 small coal mines were worked in this county for local use, producing about 38,000 bushels, or 1,900 short tons, for a population of 10,249. The coal is classed as semi-bituminous; the production of the mines ranged from 100 to 2,400 bushels; all the workings were in a 4-ft bed. The largest product was from mines near Buckhannon, where those of A. Faught, J. Ours, J. W. Reger, A. Leets and S. Strader produced from 2,000 to 4,200 bushels each.

Braxton County, W. Va., of which Sutton is the county-seat, lies S. of W. from Upshur, from which it is separated by a long corner of Lewis. About half of the county is drained by Little Kanawha headwaters, flowing N.W., and the other half by those of Elk river flowing S. W. It is wholly in the Great Ohio Coal Basin, the N. W. half having Upper measures (XV and XVI, for surface rocks, and the S. E. half Middle measures, (XIII and XIV.) The "Pittsburg" coal bed outcrops, for 28 miles, crossing the county in a N. E.-S. W. direction, dividing it into nearly equal parts. During the 10th Census year 39 small coal miues, for local use, were worked in this county, (29 mining to sell,) producing about 37,500 bushels, or 1,900 tons, for the use of a population of 9,787. The product of the mines ranged from 250 to 2,500 bushels; those producing over 1,000 bushels were: near Braxton C. H., those of S. Barrow, A. Zimmerman, J. R. Miller, J. Weiner, and A. Spangy; near Bulltown, those of W. Sturtz, J. Bender, J. Switzer, T. Crissy, J. H. Huston, and F. G. Neff; and near Twistville, those of P. I. Humbert, D. Mitchell, J. D. Homer, J. Sipe, E. Stack, S. R. Fechtig, and A. Trimble.

One iron ore mine was worked in coal measures ore, on Strange creek, to supply the furnace of Elk River Iron Co., and some 2,500 tons were mined.

Doddridge County, W. Va., of which West Union, on Baltimore & Ohio RR. is the county-town, is a northwestern county, only Wetzel lying between it and the Ohio. The head-streams of Middle Island creek of the Ohio drain most of the county, only the southern part is drained by Hughes creek of Little Kanawha. It is wholly within the Upper measures of the Great Ohio Coal Basin. Parkersburg branch of B. & O. RR. crosses the county from east to west.

During the 10th-Census year 40 small coal mines were worked in this county, producing some 1,654 tons of coal. Those that mined over 1,000 bushels, of 70 lbs. each, were G. Ford of Long Run; Thos. Coulehan, John Fleming, A. T. Gaines, R. Maxwell, A. Jennings, J. W. Longaker, and U. Chapman of West Union; M. Summers of Oxford; Theo. Dawson, and A. G. Leatherman of Morgansville; and Jas. Morrison of Smithton.

The 14 mines worked in West Union district were in a 4-ft. bed, so also were the 5 in McClellan, and the 6 in Oxford; the 8 in Grant district and the 6 in Southwest were in a 5-ft bed. McClellan and Grant are northern districts, West Union is central, and Oxford and Southwest are southern ones.

Tenth Census Work.—The Geographer of the census, Mr. Henry Gannett, writes to us for information in reference to the area of Virginia, which he has been calculating from all available data.—He also asks us for all the facts possible regarding the navigable streams of Virginia and West Virginia, for use in the forthcoming census reports. Among the facts wanted are: A list of the navigable rivers, (those actually navigable and those that have been legally declared so); their miles of navigable length; the locations of their heads of navigation; whether available at all stages, or only at high water, and for what kind of craft; the obstructions to navigation and the works undertaken to remove or obviate them. He also desires to know the amount of water carried by each stream at various stages; its average width, depth, and velocity of current; the time of year and duration of its annual flood; the character of the valley of the stream, whether broad or narrow, whether limited by bluffs or the reverse; and to have any other information in reference to our water courses.

[Microscopic View of Richmond Infusorial Earth, by Ehrenberg]

The Infusorial Earths of Virginia, the Diatomaceous Sands of M. Coryell's article on page 6 of our Jan. 1881, No., are quite fully treated of in this issue by the papers of Professors Rogers and Bailey, reproduced from rare publications. By the courtesy of Messrs. D. Appleton & Co., the great publishers of New York, we are enabled to illustrate the descriptions of these papers with Ehrenberg's picture of some of the remarkable forms of organic remains found in the earth of the Richmond infusorial stratum, when seen under the microscope, which they have generously furnished us from their Le Conte's Elements of Geology, a text book of rare excellence, and one that we commend to our readers having use for such a work, as we hope many of them have.

When Rogers and Bailey wrote these papers these remains were believed to belong to the lowest order of the animal kingdom, the one at the border line where the forms of animal life and plant life meet and mingle in such a way as to make it difficult to decide which is which, and so they called them animalculæ. Now, after these remains have been carefully studied and compared with living forms, found abundantly in the oceanic waters off our own coasts, they are, under the name of *diatoms*, *desmids*, etc., known to be the siliceous fragments of *algae*, one-celled microscopic plants that abound in the soft ooze of the bottom of all ponds, lakes, hot springs, sluggish wuters, and in the quiet deeps of the ocean itself, and even floating in the water, where they make the pastures on which *rhizopods*, microscopic animals of the lowest order, feed, as we learn from the recent splendid works of Leidy, Baird and others.

Vast beds, similar to those in Virginia, are now forming in the bottom of the sea and in the deep lakes and hot springs of the far west; and similar beds are found among most Tertiary rocks, as in California, where one bed, near Monterey, is 50 ft. thick, and in Bohemia, where the deposit is 24 ft. thick, each cubic inch of which Ehrenberg calculated to contain 40,000,000.000 of these siliceous casts. These deposits, says Le Conte, can often be recognized, even without microscopic examinations, by their soft, *chalky* consistence, their *insolubility* in acids and their extreme *lightness*.

Tripolite, or Infusorial Earth, says Dana in his Mineralogy, is used as a polishing powder; also to mix with nitro-glycerine and make dynamite: and, owing to its poor conduction of heat, it is applied as a protection to steam boilers and pipes.—Why may not a market be found for the Virginia Tripolite for these purposes?—EDITOR.

The Chesapeake & Ohio is taking rapid strides toward the destiny its projectors had in view. In a short time it will have rail connections with the west, and will enter the field as a trunk line to the seaboard. It has secured able traffic managers and will make a strong fight for through business. That it is capable of development into one of the leading avenues of trade is indisputable.—*Railway Review, of Chicago, April* 23, 1881.

Fossil Infusoria of Virginia and Maryland.

By Prof. J. W. BAILEY.

NOTE.—In his Virginia geological report for 1840 Prof. W. B. Rogers described the "Infusorial Stratum and Associated Tertiary Beds in the vicinity of Richmond," which description we reproduce in this number. He submited samples of the earth of this stratum to Ehrenberg, the famous microscopist and paleontologist, and he published "Observations on the Fossil Infusoria" which he found in that earth. The following paper, by Prof. Bailey of West Point, also a celebrated microscopist, (from the *Am. Journal of Sciences and Arts*, Vol. 48, No. 1,) is a review of "Ehrenberg's Observations on the Fossil Infusoria of Virginia and Maryland, and a comparison of the same with those found in the Chalk Formations of Europe and Africa."—EDITOR.

The principal object of this memoir is to present in a tabular form the names of the species found in the American tertiary deposits, and of those detected in the chalk marls of Oran in Africa, Caltasinetta in Sicily, and Egina in Greece. The tables also indicate which species are still living, and therefore show the relations of the present world with the tertiary and succeeding epochs. Among the interesting results of this examination presented by Ehrenberg, are the following:

1st. The remarkable difference which is shown by the American deposits of marine infusoria from those of Oran, Caltasinetta, &c., in the total absence of the calcareous shelled Polythalamia. The siliceous and calcareous shelled animalcules occur together in great numbers both in the present seas and in the chalk marls of Europe and Asia, but no Polythalamia have yet been found in any of the specimens of American infusoria examined by Ehrenberg,* from which he was at first incorrectly led to suppose that the specimens had been treated with acids to remove the calcareous matter. Ehrenberg remarks that these marine deposits of exclusively siliceous animalcules are not however without analogy, as is shown by the formation of all writing chalk from calcareous animalcules alone, and by the existence of many fresh water deposits of purely siliceous infusoria.

2d. The comparison or the forms from Richmond, Petersburg, and Piscataway, proves that the infusorial mass at Richmond is composed of at least 112 species, that of Petersbug 67, and that of Piscataway, Maryland, of 67 also.

3d. The two deposits of Virginia have about 46 species in common out of 130, or about one-third; Richmond has 66 species which have not been found at Petersburg, and Petersburg 18 not yet found at Richmond. Both of the localites in Virginia agree with that in Piscataway, Md., in 46 species out of 155, or about two-sevenths. In Virginia are found 84 species not detected in Maryland, and in Maryland 21 not found in Virginia.

4th. Of the 155 North American forms, 60 (52 Polygastrica, 8 Phytolitharia) agree with those which occur as fossils at Oran, Sicily, and Egina, and 30 (27 Polygastrica, 3 Phytolitharia) are iden-

tical with those which at Caltasinetta undoubtedly belong to the chalk formation.†

5th. It appears that the exclusively American genera do not, as was at first supposed, present only single species. The genus Goniothecium has now 7 species, Rhizosolenia 2, and 4 species of a new genus, Dicladia, have been detected.

6th. The number of genera not yet found any where but in America has been increased by this examination from 6 to 11, and it is probable that the *Triceratium spinosum* of Bailey will form a twelfth, which may be called Tetrachæta, and which differs from Triceratium as Denticella does from Biddulphia, but has 4 instead of 2 lateral spines.

From Ehrenberg's account of the new American genera we have selected the following as presenting the distinguishing characters of some of the most interesing siliceous shelled Polygastrica.

The four genera Asterolampra, Eupodiscus, Aulacodiscus, and Symbolophora, belong to the family of Naviculæ, and resemble Coscinodiscus in their orbicular form and not by forming chains. They are distinguished as follows:

1. ASTEROLAMPRA. Divided in the central portion alone into perfect cells by slender septæ, which do not reach the margin, alternating with radii which reach the margin and which are not supported by septæ.

One very elegant species, *A. Marylandica* with 8 marginal radii, occurs at Piscataway, Md.

2. EUPODISCUS. Having tubular processes with perforated apices near the margin of both sides. The name Eupodiscus is now substituted for the old name Tripodiscus, which is rejected as inappropriate, as Ehrenberg has by his own observations confirmed our statement that the number of processes may be greater than three. The species with 6 projections is called *Eupodiscus Rogersii* by Ehrenberg, while the one with seven is called *E. Baileyi*. We still think that the number of the processes will prove to be variable even in the same species.

3. AULACODISCUS. Having (instead of the tubular pediform, processes of Eupodiscus) clefts radiating from the centre to tubercles near the margin, and with the surface granular, not cellular. One species, *A. crux*, is found fossil at Richmond.

4. SYMBOLOPHORA. Having the septæ and cells radiating from a solid angular centre; surface not cellular. The only species, *S. Trinitatis*, from Piscataway, is a very remarkable and elegant form.

5. RHAPHONEIS. Has not the orbicular form of those just described, but is quadrangular, navicula-like, not forming chains, and having neither the ribs, lateral aperture, or umbilicus of Navicula, but with the sides marked in the middle with a longitudinal suture. Six species are described, among which we recognize several forms which are quite common in the fossil infusoria of Virginia and Maryland, as well as in the living state upon our sea-coast.

6. DICLADIA. This genus is doubtfully referred to the Bacillaria. It has the lorica, simple bivalve, siliceous, one-celled, not forming chains, valves unequal; one turgid simple, the other with two horns which are sometimes branched. This genus includes the curious forms of unknown origin which we have represented in Plate III, figs. 24 to 27, Vol. XLVI. of this journal.

Besides the account of the new genera, Ehrenberg also gives in his memoir the characters of 140 new species of microscopic Polygastrica, Polythalamia, and Phytolitharia, more detailed accounts of which will be given in his forthcoming volume, a work which will be eagerly sought for by all lovers of this fascinating branch of paleontology.

It may be interesting to add to the above, that in a letter recently received from Ehrenberg he gives us the following authentic names of several of the forms represented in Plate III, Vol. XLVI. of this Journal.

Figs.	Bailey.	Ehrenberg.
1, 2,	Podiscus Rogersi	=Eupodiscus Rogersii.
3 to 9,	Zygoceros (Biddulphia) Tuomeyi	=Denticella tridentata.
10, 11,	Zygoceros rhombus	=Denticella rhombus.
13, 15,	Navicula concentrica	=Goniothecium Rogersii.
24, 27,	Bodies unknown nature	=Dicladia.
29, 30,	" " "	=Rhizosolenia.
21,	Bodies with large cells	=Lithocampe radicula.

*No Polythalamia have been found in any of the infusorial matters which we have examined from as many as 20 localities in Virginia and Maryland; but as they abound in other beds of the eocene and miocene tertiary, it cannot be supposed that they did not also exist during the deposits of the infusorial beds. It appears probable that chemical changes have destroyed the minute calcareous shells without affecting the siliceous ones. That such changes have taken place is shown by the fact that in all the specimens of the infusorial beds which we have seen, *casts* alone of the shells of the large mollusks are preserved. J. W. B.

†As Ehrenberg in his tables indicates a doubt as to the tertiary character of our infusorial deposits, it is proper to state for the information of those not familiar with American geology, that the infusorial strata of Maryland and Virginia are certainly of the epoch of the miocene tertiary, as is shown by their containing casts of miocene fossils and by their having strata of numerous and well preserved miocene fossils both *below* and *above* them. J. W. B.

Notes on the Mines of the Robinson Coal Co., Coalburg, W. Va.

By NEIL ROBINSON, Manager.

Output for the year 1880, 70,208 tons, distributed as follows:

Loaded in barges at mines, ...	3,804 tons
Shipped west over C. & O. Ry., ...	46,322 "
Shipped east over C. & O. Ry., ...	20,082 "
Total output, ...	70,208 tons

The larger portion of the coal shipped east went to the Richmond and New York markets. This coal was used, throughout the year, by the Longdale Iron Co., for their locomotives, and during Nov. and Dec. shipments were made to the Low Moor Iron Co. for a light mixture with their coke, and used in the furnace. Of the coal shipped west 12,000 tons were taken by the Kentucky Central RR.—customers for the last 12 years. A recent report made by the Gen'l Supt. of the road, J. R. Ledyard, Esq., states that the average consumption of Coalburg coal is 30 lbs. to mile of trains moved. He gives it as his opinion that 25 lbs. will do the work proper of moving the trains.—The demand for this coal in 1880 was greatly in excess of the capacity to produce. Among the southern cities to which shipments were made we may mention, Charlotte, N. C., Atlanta, Ga., Lynchburg, Farmville and Danville; Va., and Raleigh, N. C.

Analysis, by Dr. G. M. Levette, of the Indiana Geological State Survey:

Fixed carbon, ...	62.00	Coke,—carbon—	63.50
Gas, ...	32.50	Volatile, ...	36.50
Water, ...	4.00		
White ashes, ...	1.50		100.00
	100.00	Specific gravity, ...	1.280
		One cubic foot weighs . .	80 lbs.

In several pamphlets issued by the C. & O. Ry., in Maury's Resources of W. Va. (p. 224). and in the paper by O. J. Heinrich in the December (1880) number of THE VIRGINIAS, the value of the Coalburg coal, for gas making, is very much misrepresented. In 1874 a quantity of *refuse* coal, underlying the Coalburg seam, was sent to the Richmond gas works for the purpose of ascertaining whether it was worth hauling out of the hill or not. They gave a report of 3.97 cu. ft. yield per lb., with a candle power of 13.90, and these figures have been used ever since as representing Coalburg coal. This is altogether wrong. Not a pound of the coal that was so tested is allowed to go in with the Coalburg. It is refuse coal which we grade and mix with slack.

To better represent the true gas making properties of the Coalburg, we give the results of tests made by the Boston Cos.:

Brookline test, ...	5.02	cu. ft.	16.9 candle-
" "	5.05	"	16.6 power
Chelsea "	4.75	"	17.5 "
South Boston test	4.78	"	17.8 "
" "	4.42	"	20.0 "

The South Boston Co. reports a yield of 37 per cent in coke per ton of coal. Our reports as to the quality of the coke are very favorable.

Coalburg is just above Lock No. 4, on the Great Kanawha river, and has excellent loading water, together with perfect facilities for loading in barges at the mines. For two years, however, all coal destined for the western markets has been hauled by the C. & O. Ry. to Huntington, on the Ohio river, and loaded in barges there. The Ches. & Ohio has two coal tipples at Huntington, a coke tipple at Ashland, and a very full equipment of rolling stock especially adapted to this trade. They have handled our coal so promptly and carefully that we prefer to ship over their line rather than load in the Kanawha.

Fish and Game.—The Va. Fish & Game Protective Association of Richmond offers 4 prizes for the scalps of large hawks and owls killed between April 1st. and Nov. 1st, 1881, to insure the destruction of such rapacious birds.—*Fish ladders* must be erected over all the dams in Va., by the owners of the dams. The supervisors inspect the dams in April and a fine will be imposed where fish-ways have not been erected.—*McDonald's fish-way*, the patented invention of Col. McDonald, the Fish Commissioner of Va., was awarded a gold medal, as the best fish-way exhibited at the late International Fish Exposition at Berlin. A large one of this patent is in course of erection at Bosher's dam, in the James, eleven miles above Richmond.

Infusorial Stratum and Associated Tertiary Beds in the Vicinity of Richmond, Va.

By Professor William B. Rogers.

(From the Va. Geol. Report for 1840.)

The peculiar feature of these Tertiary beds, in view of which I have proposed devoting to them a distinct consideration, consists in the occurrence of a very remarkable stratum varying from 12 to 25 ft. in thickness, composed almost entirely of microscopic fossils between the beds containing the Eocene and those containing the Miocene impressions.

This stratum, more particularly described below, giving no indications to the naked eye, or even under an ordinary microscope of its real composition, was until recently regarded by me as nothing more than a clay of unusualy fine texture, such as is not unfrequently met with in the group of Tertiary strata. Nor was its true nature unfolded till struck by its remarkable lightness and its almost exclusively silicious composition, and adverting to the recent discoveries of microscopic fossils in Europe, I was led to inspect it through a powerful microscope, when I found it to be made up almost entirely of exquisitely minute and delicate organic remains.

These curious relics, too minute to be described by the most penetrating eye, thus accumulated in a compact form into a stratum of great thickness, belong to a class of objects, which of late years have excited much attention in Europe, from having been found to constitute an important portion of the mass of extensive beds of earth and rock, and to be in fact the shells and sheaths of various animalculæ, analogous to those which are met with in countless numbers in the waters of pools and marshes and in the sea, and which are denominated *Infusory Animals*.

Until the recent researches of the celebrated Ehrenberg disclosed the important agency of these minute beings in the production of some of the mineral masses belonging to former geological eras, as observed in Europe, no one had ever dreamed of finding whole strata of great thickness and extent, literally made up of these shells and their solid appendages; yet nothing is more certainly established than that those remains form not only the principal material of the light white earth which is known gradually to accumulate in peat-bogs and in other moist situations, of the Leaf Tripoli found in many parts of Germany in widely extended beds of many feet in thickness, of the Semi-opal and other dense products met with in these beds, and of the common gun-flints found in layers of nodules running through strata of chalk, but that they compose in the shape of calcareous, as well as silicious shells, and especially the former, nearly the whole substance of the vast strata of the chalk itself overspreading extensive districts of Europe to a depth in many places of several hundred feet. In view of these interesting facts the discovery of the *Infusory stratum* above referred to, as one of our series of Tertiary deposits, cannot fail to be regarded as an important addition to our knowledge of the Tertiary of the country, and has the greater interest at present, from being the first example yet observed in the United States, of the occurrence of Infusorial remains in any but the most recent geological formations.

The most extensive developments of this stratum hitherto met with, are presented in the hills in the immediate vicinity of Richmond, as described below, and on the north bank of the Rappahannock river, in the nighborhood and for some distance east of the eastern boundary of the Eocene on that river. The latter locality already alluded to in connection with the geology of the Northern neck, not lying within the tract of which I am now treating, does not properly claim to be described under the present head, and from having been visited long before the existence of Infusorial remains in our Tetiary was even suspected, will merit further and more minute explorations.

Having adverted to the general character of what are called Infusorial remains above, I shall confine myself in what follows to a brief description of the more striking peculiarities to our Infusorial stratum, and thence proceed to a sketch of the geology of the district in and adjoining Richmond, in which it has been my good fortune to find it developed.

The material in question, composing a thick stratum lying between beds of sand and clay, is more or less mingled with them, particularly in the vicinity of its bounding surfaces. But throughout most of its thickness, it presents a very fine texture, admitting of being bruised by the fingers into an almost impalpable powder, and singularly free from gritty particles. Its color in the present specimens, is a very light gray or white, but the fragments into which it spontaneously divides at the exposed surface of the stratum, often present externally a slightly ochreous tinge. It is decidedly, though sometimes indistinctly laminated, the planes of the thin flakes or sheets being horizontal. When moistened, it displays considerable tenacity, and hence has hitherto been regarded as a fine clay or fuller's earth. Of all its peculiarities, however, capable of being readily discovered, its lightness is the most extraordinary and characteristic. When quite free from moisture, a pure specimen has a specific gravity of only 0.334, that is to say, only one-third the weight of water, bulk for bulk.

It adverting to the curious and astonishing fact of its being composed almost entirely of the shells and other appendages of former races of animalculæ, it was also mentioned that unlike the microscopic remains composing the chief mass of chalk or the larger fossils of our marl beds, these minute relics consist entirely of *siliceous* instead of calcareous matter. For this reason it is that the Leaf Tripoli, Polir Scheifer of Bohemia, as well as other analogous Infusorial products, have so long been found valuable in giving a polish to metallic surfaces. Our infusorial matter, when properly selected, is capable of being employed for this purpose with no less advantage, and from the trials I have made, I feel assured that when exempt from grit, it may be very usefully substituted for the finer varieties of the Tripoli or rotten stone of the shops.

Of the forms of these microscopic remains, no just conception can be conveyed to the general reader without the aid of drawings representing them on a greatly enlarged scale. I may however remark, that while these forms are very numerous, and refer themselves to many distinct species of animalculæ, they may in a popular way be described as for the most part referable to two classes.—One of these is an oblong cylinder, rounded or knobbed at the extremities, and containing within a multitude of rings arranged parallel to each other, from end to end, and forming, as it were, the internal skeleton of the animal. The other is a round disc, more or less convex, and sometimes nearly spherical, often perforated through the centre, and presenting over its surface an exquisite net work of inconceivably minute belts.

Of the minuteness of these objects, some idea may be formed from the following statements:

The cylindrical bodies of the medium size are from 1-300th to 1-400th part of an inch in length, and from 1-1200th to 1-1600th in width, but many fall greatly short of these dimensions.

The rings, which are found separate in great numbers, are usually from the 1-1500th to the 1-2000th of an inch in diameter.

The circular discs and convex bodies, reticulated with cells, vary from 1-100th to 1-600th in diameter. In each of these are hundreds and even thousands of beautifully wrought cells. The predominance of these flattened forms appears to be the cause of the laminated texture already mentioned as exhibited by the Infusorial earth.

It is obvious from these facts, that the number of such fossils comprised in each cubic inch of the material, can only be reckoned in millions or hundreds of millions, and that a bushel measure would contain a number of these skeletons and shells of former races of animalculæ, far exceeding the entire population of the globe

Of the important geological agencies of the living races to which these remains belonged, we need no more striking illustration than will be furnished in the following sketch of the extent and relations of the Infusorial stratum. And I may add that while, as formerly remarked, this stratum at Richmond and on the Rappahannock, furnishes the only instance in which these remains have been found in the United States, forming portions of any formations but those of the present epoch, its thickness and the extent over which it is spread out, entitle it to rank with the most interesting beds of siliceous Infusorial remains yet discovered in Europe.

The valley of Shockoe creek, lying between Shockoe hill and Church hill, affords numerous favorable opportunities for observing the position of the Infusorial bed, and the strata with which it is associated, by explorations along the sides of the bounding hills and the deep ravines by which, in many places, they are abruptly trenched.

The middle of this valley is occupied by coarse gravel, rarely discovering any materials *in situ*. Beside the stream, a little to the left of the crossing of Shockoe hill Main street, as continued over towards Church hill, a patch of primary rock is displayed, consisting of Gneiss containing some Hornblende, and intersected by several veins of Felspar.

At the base of Shockoe hill, a short distance up the principal ravines, the felspathic sandstones and conglomerate may be seen, forming the channels of the little rivulets flowing in these hollows, and rising where best exposed to a height of about five feet above the bottom of the ravine. Of course, near the outlet of the hollow, the heavy diluvium from the upper part of the hill conceals or replaces everything else, and neither the felspathic sandstone nor the overlying beds can be seen, until we enter some depth into the ravine. We may thence trace it upwards, until, in consequence of the slope of the surface, we reach a higher level than the upper limit of this rock, when it disappears from view. This stratum consists of the felspathic sand in irregular layers, loosely cementing

pebbles of various dimensions from 1 to 4 or 5 inches, some of which belong to Formation I. An analogous material is still more extensively exposed in the mill race at the mill, higher up the creek, and composes the knoll on which the mill is placed. Here we find the felspathic sandstone in general much stained with ferruginous matter, overlaid by a bed of very coarse conglomerate of an ochreous stain and unusual hardness. Similar sandstones and conglomerates are displayed at various points along the margin of the stream, for a thickness of several feet above its surface.

Resting upon this sandstone and conglomerate, we meet with beds of sand and sandy clay of a dark greenish and lead color, and of a light grey, mottled with yellow, containing sharks' teeth and Eocene *Carditas*, *Turritellas*, *Crassatellas*, &c., in the form of casts, together with vague vegetable remains in a carbonized condition. The contact of these Eocene strata with the underlying sandstone, is well displayed at the following points:

1st. The ravine adjoining Shockoe hill Main street, where the culvert opens.

2d. That heading immediately in the rear of the Monumental church.

3d. That between Col. Ambler's hill and French Garden, by far the most prolonged of the ravines on this side of the valley.

4th. That next above Freneh Garden and between it and the Poor-house. Above the point last named, the sandstone is buried out of view, and the lowest stratum seen belongs to the Eocene.

Above the Eocene beds occurs the enormous deposit of Microscopic remains, which I have called the Infusorial stratum, having the light grey or nearly white tint, and the astonishing lightness before described.

This stratum shows itself at nearly the same level on the hill sides, and in the ravines on both sides of the valley of Shockoe creek, and may be traced on the Shockoe hill side of the valley, without interruption, as far as the crossing of the Hanover road towards the head of the valley and near Turner's mill. From a point on the slope of Church hill, a little beyond Butchertown, commanding a view of the hills and ravines from the Poor-house down, it is easy to trace the broad belt of this deposit by its surface being comparatively devoid of herbage, and presenting a white and barren aspect.

The thickness of the stratum varies at different points from 12 to 25 feet, the most striking exposures being those met with in the ravine behind the Monumental church, and that between Col. Ambler's and French Garden.

The same, or a very similar order is observed in the exposures visible on the opposite side of the valley along the slope of Church hill.

At the bottom of the ravines, which are here comparatively shallow, we see the upper portions of the Eocene, and over this the Infusorial stratum, showing itself plainly and of great thickness, at the following points:

1st. Just back of Butchertown, on the two roads that extend up the hill.

2d. At the foot of the abrupt bare bank which has been cut into north of Main street, on Church hill, and thence south nearly to the next street.—Indeed, along the slope of Church hill, as on the other side of the valley, this stratum may be found in all the ravines and cuttings, at the proper level.

Above the Infusorial stratum, are lead colored and ochreous sands and clays, sometimes nearly resembling it in color, but readily distinguished by their greater heaviness. These, which belong to the Miocene division of the Tertiary, are remarkable for containing, near and for some distance above the Infusorial stratum, numerous vegetable markings of a vague description, as well as many well defined impressions of leaves and stems; and towards the top, impressions of Scallop shells (*Pectens*) and other Miocene fossils.

Among the numerous points at which these strata are exposed, the following may be mentioned as interesting and easy of access:

1st. On Governor street, as you descend Main street, where the impressions of the shells are very numerous.

2d. The steep bank opposite the Synagogue. Here the clays near the base, abound in vegetable impressions, among which are admirably defined leaves. Towards the top, the more sandy material contains impressions of *Pectens*.

3d. On Church hill, back of Mr. Van Lew's garden, and the bare bank exposed along the valley side of the hill behind Mr. Greaner's dwelling. The base of this bank is on a level with the top of the Infusorial bed.

The minute details which have now been presented in relation to the Infusorial bed and its associates, though unimportant to the general reader, are here given, that those residing near may be enabled to gratify their curiosity by observing for themselves the extent and relations of this curious deposit. I will now conclude the subject with the following:

Section of the Strata Disclosed in the Principal Ravine on the West side of the Valley of Shockoe Creek, Richmond, Va., from the surface downwards:

	Feet.
I. QUATERNARY.	
1. Beds of diluvium, composed of sand and gravel, forming the surface, and the highest of the deposits in this vicinity,	...
II. MIOCENE AND PLIOCENE TERTIARY.	
2. Beds too imperfectly exposed for accurate observation, .	...
3. A more sandy stratum of mottled gray and yellowish brown, with vegetable impressions and points of *Pectens*,	14
4. Greenish brown and lead colored clays, with vegetable impressions, ...	6
5. *Infusorial Stratum*, ...	29
III. EOCENE TERTIARY.	
6. Lead-colored heavy clay, with a greenish tinge, ...	3
7. Brownish black stratum, containing a few prints of fossils and a large amount of carbonized vegetable matter, to which the color of the stratum is owing, ...	5
8. A lighter colored bed, with yellowish blotches, and streaks very friable, even when moist, being more sandy than the following; contains a few impressions, . . .	8
9. Dark olive and bluish stratum, tenacious while moist, but becoming mealy and of a grayish tint when dry, and in that condition showing an efflorescence of gypsum upon the surface. Impressions of *Cardita*, etc., ...	4
IV. JURASSO-CRETACEOUS, OR UPPER SECONDARY.	
10. Felspathic sandstone of Upper Secondary, ...	4
Section exposed, ...	64 ft.

The Iron and Steel Industries of the Virginias in the Census Year 1879--1880.—Census Bulletin No. 94, the preliminary report of special agent James M. Swank upon the iron and steel industries of the U. S., during the 10th-census year, has been received from the census office.—We gather from it the following facts in reference to these industries in Virginia and West Virginia. All the quantities given are in net, 2,000 lbs. tons.

	Virginia.	West Va.
Total production of iron, in tons	55,722	147,487
Relative state rank in production of iron	16th.	7th.
Whole number of blast-furnaces, rolling-mills, steel-works, forges and blomaries	44	20
Capital invested in production of iron	$4,329,713	$3,913,616
Hands employed, Males over 16 years old	2,399	3,780
Hands employed, " under 16 years old	121	341
Hands employed, Females over 15 years old	2	....
Total number of hands	2,522	4,121
Total amount paid in wages	$665,432	$1,541,816
Value of all materials used during census year	$1,496,151	$3,484,625
Value of all products made " " " "	$2,585,999	$6,054,032
Weight, in tons, of all products made during census year	55,722	147,487
Pig iron, including castings, in tons, made direct from furnace	17,906	80,050
Rolled iron, net tons made	35,176	67,437
Blooms made from ore, net tons	58	.....
Blooms made from pig and scrap iron, net tons	2,582	.....
Castings made direct from furnace, net tons	121	367
Sheet iron made, net tons	.....	4,340
Cut nails made, kegs of 100 lbs. each	101,640	1,055,900
Hoop-iron made, net tons	.....	240
Iron rails made, net tons	.....	3,333
Total production of all kinds of rails, net tons	.....	3,383

Virginia, in the census year 1870, produced 37,846 tons of iron of all kinds; its 1880 product was 55,722 tons, or 47 per cent greater than that, but it receded in rank from the 13th to the 16th, Illinois, Tennessee and Alabama stepping above it; a condition of things that would have been changed if the census had been taken 4 months later, since most of the Virginia furnaces did not go into blast until after June 1st, the end of the census year.

West Virginia produced 72,337 tons in 1870; its 1880 product was 75,150 tons more than that, a remarkable increase of 104 per cent, enabling it to move up in rank from the 10th to the 7th place, among the iron-producing states, stepping over Massachusetts, Michigan, Kentucky, Missouri, and Maryland, which were all ahead of it in 1870, but having to be outstripped itself by Illinois and Wisconsin which ranked 15th and 12th in 1870.—Ohio county, W. Va., produced 84,767 net tons, enabling it to rank as the 3rd among the 17 counties of the 2nd rank in production in the Union.

The total iron and steel production of the United States in 1880 census year was 7,265,140 tons, an increase of 98.76 per cent over that for 1870. The Virginias produced 203,209 tons of the 1880 product, or less than 3 per cent of the whole.

In the production of pig iron W. Va. ranked 9th and Va. 17th; in that of rolled iron W. Va. was 7th and Va. 12th; in that of sheet iron W. Va. was 6th; and in that of cut nails Va. was 10th and W. Va. 2nd.

The raw materials used in the manufacture of iron and steel in the U. S. during 10th census year were: iron-ore 7,709,708 tons, limestone 3,169,149, anthracite 3,322,498, bituminous coal 5,596,635, coke 2,277,555, mill-cinder 354,048, pig-iron 2,596,635, old iron rails 708,534, scrap-iron 447,078, ore blooms 43,411, pig or scrap blooms 49,511, muck bar purchased 53,754, spiegeleisen 86,138, old steel rails and crop ends 85,653, Bessemer steel ingots and blooms purchased 42,939, open-hearth ingots and blooms purchased 17,713, scrap steel 110,371, Swedish billets and bars 10,410, other billets and bars 16,496, and 853 barrels of oil and 69,592,091 bushels of charcoal.

The centre of production, or the pivotal point of the plane on which the distributed production would balance, for the U. S., was between Indiana and Armstrong counties, Pa., N. lat. 40° 43′, W. long. 79° 20′, a point 180 miles due north from Ferrol furnace, Augusta county, Va.

Belmont furnace, of Belmont Nail Co., Wheeling, W. Va.,—reported in Swank's U. S. Iron and Steel Works, 1880, as one stack 63x14, first blown in Sept. 4, 1875; closed top; fuel, Connellsville coke; ores, lake Superior and Missouri; specialty, No. I mill pig iron,—says the *Iron Age* of April 21, made 16 tons of iron in one day this week, and that manager McCune has brought it up to a producing capacity that its owners hardly thought it capable of.

The Shenandoah Valley Railroad was, on Monday, April 18th, 1881, opened to travel and traffic for the entire length of the 144 miles of its Shenandoah-valley division, that extending from Hagerstown, Md.,—its junction with the Western Maryland RR. leading to Baltimore, and with the Cumberland-valley RR. of the Pennsylvania Co., leading to Philadelphia and New York and Pittsburg and the West—to Waynesboro, Va.,—its junction with the Chesapeake & Ohio Railway which leads to Richmond and the Southwest, and to Cincinnati and the West—and now *three passenger trains are running daily*, except, it is gratifying to state, on Sunday, each way, from Waynesboro to Hagerstown, and, without change of cars, to Baltimore and Philadelphia, making close connections with the Chesapeake & Ohio, the Baltimore & Ohio, the Western Maryland and the Pennsylvania railways.

This event is to the Virginias one of the most important that has recently occurred, for by it one of their great iron ore belts is opened for development and placed in direct communication with their coals and cokes, and a delightful route is opened for travel, over a well constructed and elegantly equipped road, by which there will be expeditious and unobstructed transit from all the central regions of these states to the great commercial cities of Baltimore, Philadelphia, New York and Boston.

The published time-table shows that the northward bound traveler can leave Waynesboro at 5.30, a. m., after the arrival of a Chesapeake & Ohio train that left Richmond at 10 p. m. previous and of one that left Huntington on the Ohio at 10.45 a. m. previous, and reach Hagerstown at 12.35 p. m., (passing through the whole length of the Shenandoah Valley, at 20 miles an hour, in a forenoon) and reach Baltimore by 6.45 p. m., Harrisburg, Pa., by 3.30 p. m., Philadelphia by 6.45 p. m., New York by 9.30 p. m., and Boston by 6.20 the next morning, or about 24 hours from Waynesboro. At 10 a. m. a mixed train runs from Waynesboro to Hagerstown by 1.30 p. m., in time for a train to Baltimore, and another passenger train leaves Waynesboro at 3.40 p. m., after the arrival of a train that leaves Richmond at 8 a. m. previous, and of another that leaves Huntington at 7.55 p. m. previous, and reaches Hagerstown at 10.45 p. m.

Southward-bound through trains leave Hagerstown at 9 and at 11.30 a. m. and at 3.40 p. m., reaching Waynesboro, the second at 6.40 and the third at 10.30 p. m., connecting with Ches. & Ohio trains.

By this road one can leave Staunton at 1.35 in the morning and arrive in Baltimore at 6.45 p. m., Harrisburg 3.45 p. m., and New York 9.30 p. m. of the same day, and in Boston at 6.20 a. m. of the next day. Arrangements will soon be completed for sleeping and chair cars to Philadelphia direct.—This will doubtless become a favorite route to and from central Virginia and West Virginia, because of its location through attractive scenery, famous battle-fields, and by the wonderful Luray Caverns.

Shenandoah Valley Railroad.—Table of stations, distances, &c.

Station No.	Shenandoah Valley RR. Stations.	County and State.	Miles from Hagersto'n.	Feet above tide.
0	Hagerstown,	Washington, Md.	....	566
6	St. James,	" "	5.9	467
9	Grimes,	" "	9.0	382
14	Sharpsburg,	" "	13.6	445
17	Shepherdstown,	Jefferson, W. Va.	16.9	405
23	Shenandoah Junction,	" "	23.1	515
28	Charlestown,	" "	28.4	517
34	Ripon,	" "	33.9	519
36	Fairfield,	Clarke, Va.	36.2	522
40	Berryville,	" "	39.9	571
46	Boyceville,	" "	46.2	575
49	White Post,	" "	49.2	610
53	Ashby,	Warren, "	53.2	600
56	Cedarville,	" "	56.4	569
59	Riverton,	" "	59.2	497
62	Front Royal,	" "	62.1	495
66	Manor,	" "	66.4	497
73	Bentonville,	" "	72.9	732
76	Overall,	Page, "	75.6	662
80	Rileyville,	" "	79.8	726
85	Kimball,	" "	85.1	895
89	Luray,	" "	88.8	822
96	Marksville,	" "	95.6	1,066
102	East Liberty,	" "	101.9	946
104	Grove Hill,	" "	104.0	966
107	Shenandoah Iron Works,	" "	106.7	940
113	Elkton,	Rockingham, "	112.5	958
127	Port Republic,	" "	127.2	1,096
129	Weyer's Cave,	Augusta, "	129.1	1,123
132	Patterson,	" "	132.1	1,135
137	Crimora,	" "	136.9	1,242
144	Waynesboro,	" "	143.7	1,284

Coal Trade of Cincinnati in 1879-80.—The growing importance of the great city of the Ohio as a market for the coals of West Virginia gives to its statistics of coal receipts a special value for us. Through the courtesy of Mr. Sidney D. Maxwell, superintendent of its Chamber of Commerce, we have the last report, that for the fiscal year ending Aug. 31, 1880, of that body, and from that authoritative report we gather the following facts in reference to the coal trade of Cincinnati.

The coal business for 1879-80 was the largest on record; the receipts were 1,787,230 tons (48,198,246 bushels, as Westerners would delight to say,) an increase of more than 40 per cent over that of the previous year, and one of 490 per cent in 27 years. The average quotations for coal, delivered, during the year, were, per bushel, for Pittsburg 13.22 cents, for Ashland 11.07, Ohio River 10.44, Hocking Valley 12.70, Raymond City 11.97, Muskingum Valley 11.93, Campbell Creek 12.55, and for Cannel 19.89.—Of the entire quantity, 93.2 per cent came by river and 6.8 by rail.

Of the aggregate receipts for the past 3 years the percentages of the whole from each source of supply were as follows:

From.	1877-8.	1878-9.	1879-80.
Pittsburg,	68.7	70.7	65.8
Kanawha River,	17.4	18.9	18.9
Ohio River,	8.5	11.9	8.9
All other sources,	5.4	8.5	6.4

The increase and hold-on of the Kanawha percentages show that these coals are beginning to take their proper place in the Cincinnati market. It is an interesting fact for our Kanawha coal trade to note, that, for coal afloat, the average quotations for Pittsburg (Youghiogheny) coal per bushel, over that from Campbell creek, W. Va., was 0.76 cent in 1877-8, 0.42 in 1878-9, and 0.40 in 1879-80. This approximation, we recently learned, has of late become nearly a conjunction, the Kanawha splint selling at the same price as the Pittsburg coal. We are awaiting an occultation, notwithstanding the sympathy of some Pittsburg papers for the Cincinnatians when

they were recently "compelled to use the inferior coals of the Kanawha Valley." Inferior in what particulars, we would be glad to know?

In the "Tuesday quotations" of each week for 1879-80 the prices for Pittsburg and for Campbell creek coals are almost identical, and for the latter half of the year they are identical.

The Common Council of Cincinnati, by ordinance, required, after April 23, 1880, all mineral coals and coke "*to be sold by the ton, of* 2,000 *lbs. avoirdupois, or fractional parts thereof*," under heavy penalties. An ordinance, says the report, "that if steadily pursued will not only protect the consumer against imposition, but will greatly simplify the transactions in coal, because it is a rule which is easily understood and followed," and, we may add, will do away with the ridiculous exhibits of big figures in western transactions in coal and remove one of the constant promoters of strikes and labor troubles.

The Virginia Agricultural Society is moving for a great exhibition in Richmond next October, the fair to begin the 12th and last 2 weeks. In the mineral department it is proposed to have a grand display, to be gathered and arranged by experts, who are to be properly compensated, the work, to be divided into some three parts; (1) Iron-ores and coal; (2) Gold, silver, lead, zinc, and all other metals; (3) Marble, granite, slate, clays, sands, &c.

It was decided to cultivate 5 acres of the fair-grounds in sorghum, so that the manufacture of sugar and syrup may be exhibited there; also to cultivate an acre in jute and a patch in ramie.

Corrections.—We use all due diligence to make all statements in THE VIRGINIAS accurate, but errors from imperfect manuscripts, and other causes, will sometimes be made. In the article on the Furnaces, &c., of S. W. Va.,—which we are pleased to note has furnished a great many of our exchanges very readable matter, but with no credit to us, we are sorry to say,—on p. 29 of this vol., please correct so that *Cedar Run furnace* may be stated to make a ton of pig iron with from 125 to 150 bushels of charcoal; the same statement should be made in reference to *Barren Spring furnace*. In fact, 150 bushels of charcoal to the ton of iron is a fair average for all the car-wheel iron furnaces of this region.

Richmond, Va., Iron market is reported to the *Iron Age*, under date of April 18, by Mr. Asa Snyder, iron merchant and furnace agent, as unchanged in prices; Virginia charcoal cold-blast car-wheel iron $37 to $39 per ton, and Va. coke pig, No. 1, $23.50. He adds: Our furnaces are selling their product as rapidly as made, and so far there is no accumulation at shipping points.

The Richmond correspondent of *Bradstreet's*, writing under date of the 6th inst., says: "The iron business is reported flourishing. An active trade exists both in bar and nails. A prominent machine and engine builder states that all of the foundries and machine shops in the city are working to their full capacity and turning out work at fair profits. One large founder says this rush is unprecedented."

Norfolk Horticultural and Pomological Society will have a horticultural exhibition at Norfolk, the 18th of May next. Numerous premiums are offered and it is expected this will be the largest dis. p'ay of vegetables and fruits ever made in Norfolk.

Production of Pig Iron in the Virginias from 1872 to 1880.—Elsewhere we have given the first return of the iron industries of the Virginias during the 10th-Census year, that from May 1st, 1879 to June 1st, 1880; below we give the Production of Pig Iron in Virginia and West Virginia and in the United States, for each year from 1872 to 1880, inclusive, giving the total number of net (2000-lbs) tons made, and also the tons made with each kind of fuel used,—compiled from the *Bulletin of the American Iron and Steel Association* of Feb. 23, 1881, from its statistics gathered from the manufacturers:

IN VIRGINIA.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.
Total Production.	21,445	26,475	29,451	29,985	13,046	12,434	16,928	18,873	29,934
Anthracite	.....	4,000	6,000	7,070	852	.....	.....	.....	.....
Bituminous Coal and Coke.	.....	.....	.....	7,519	4,844	6,241	10,595	11,170	15,891
Charcoal	21,445	22,475	23,451	15,396	7,350	6,193	6,333	7,703	14,043
IN WEST VIRGINIA. Total Production.	20,796	23,056	30,134	25,277	41,165	34,905	50,667	70,801	70,338
Bituminous Coal and Coke.	19,846	21,106	26,734	24,177	40,865	33,655	50,261	70,601	67,093
Charcoal	950	1,950	3,400	1,100	300	1,250	406	200	3,245
IN THE UNITED STATES. Total Production.	2,854,558	2,868,278	2,689,413	2,266,581	2,093,236	2,314,585	2,577,361	3,070,875	4,295,414
Anthracite	1,369,812	1,312,754	1,202,144	908,046	794,578	934,797	1,092,870	1,273,024	1,807,651
Bituminous Coal and Coke.	984,159	977,904	910,712	947,545	990,009	1,061,945	1,191,092	1,438,978	1,950,205
Charcoal	500,587	577,620	576,557	410,990	308,649	317,843	293,399	358,873	537,558

The above table shows that in Virginia there were made 11,061 more tons of iron in 1880 than in 1879, an increase of about 60 per cent, while that for the whole United States was about 40. The gain in Pennsylvania for the same year was less than 30 per cent. Virginia's increase in production of bituminous coal and coke iron in 1880 was more than 42 per cent over that of 1879, while that for the whole of the United States was 35 per cent. The increase in production of charcoal iron for same times in Virginia was over 82 per cent, while that for the United States as a whole was less than 50 per cent.—These gains, by themselves as well as by contrast, show how rapidly Virginia is progressing in the development of this great industry. The also show how rapidly the production of iron with bituminous coal and coke is gaining on that with anthracite, and how good must be the demand for charcoal iron.

In statement of the condition of U. S. furnaces Dec. 31, 1880, this report credits Va. with 37 furnaces, 13 in blast and 24 out; and W. Va. with 11, of which 4 were in blast and 7 out, differing from the *Iron Age* report of Jan. 1, 1881, given elsewhere.

The National Board of Health has its headquarters at Washington, D. C., from which it issues a weekly Bulletin reporting the mortality statistics of the United States and giving sanitary and other health information. Dr. James L. Cabell, of the Uuiversity of Virginia, is president of this board; its Virginia correspondent is Dr. J. W. Mallet of the University of Virginia, and the West Virginia one is Dr. S. L. Jepson, of Wheeling, W.Va.

The National Academy of Sciences has recently held a meeting at Washington, D. C., which was presided over by the venerable Professor William Barton Rogers. Prof. J. W. Mallet read a paper on "Results just obtained with regard to the Molecular weight of Hydrofluoric Acid," results doubtless, from the special work of his laboratory at the University of Va.

Drinking water suspected, on good grounds, as the cause of disease, will be analyzed by Dr. J. W. Mallet of the University of Virginia, when reported to him and instructions have been received in reference to it, entirely at the expense of the National Board of Health.—*National Board of Health Bulletin*, Jan. 29, 1881.

Condition of Blast-Furnaces of Va., W. Va., and U. S., April 1, 1881.—We compile the following from the quarterly report of the *Iron Age* from its April 21, 1881, number:

	Total Number of Stacks.	In Blast. Number Reported	In Blast. Capacity per week in tons	Out of Blast. Number Reported	Out of Blast. Capacity per week in tons
1. CHARCOAL.					
Virginia	30	11	535	19	815
West Virginia	6	1	100	5	407
United States	275	139	13,505	132	10,433
2 BITUMINOUS AND COKE.					
Virginia	8	7	1,445	1	90
West Virginia	6	5	1,725	1	160
United States	219	155	48,410	64	16,425
3. TOTALS					
Virginia	38	18	1,980	20	905
West Virginia	12	6	1,825	6	567

Virginia is also credited with 1 anthracite furnace out of blast, with a capacity of 140 tons per week.

The table only gives the stacks from which the Iron Age had reports. It includes some furnaces that are re-building and some building but not completed. The capacity is probably in excess of the actual production. The number in blast in the U. S. was 453, those out of blast 276. Compared with report of Jan. 1, 1881, it shows in U. S., in blast, 21 less charcoal furnaces, 3 less anthracite, and 4 more bituminous and coke. There is a large falling off in the number of anthracite furnaces in blast compared with a year ago; "a condition of affairs that it is difficult to give a good reason for," says the Iron Age, but one that we think can be readily accounted for by the cheaper production of iron elsewhere, especially in Virginia and other Southern states.

In the Iron Age report of the condition of U. S. blast-furnaces, Jan. 1, 1881, (published Jan. 13, 1881), Virginia is credited with 39 stacks of which 15 were charcoal in blast having a weekly capacity of 643 tons, 15 charcoal out of blast with 680 tons weekly of capacity, 8 bituminous coal and coke in blast with a weekly capacity of 1,335 tons, and 1 anthracite of 140 tons capacity out of blast; West Virginia with 12 stacks, 1 charcoal in blast with 100 tons capacity, 5 charcoal out of blast with 407 tons capacity, and 6 bituminous or coke in blast with 1,645 tons capacity.

The Virginian changes in the 3 months of 1881, according to the *Iron Age* were as follows: In Virginia, none in number of stacks, a decrease of 4 in charcoal ones in blast and of 108 tons in capacity, an increase of 4 charcoal ones out of blast and of 135 tons of capacity; a decrease of 1 bituminous and coke in blast, but an increase of 110 tons of capacity.—In West Virginia, no change in charcoal furnaces, but in bituminous or coke a decrease of 1 in blast and 180 tons in capacity.

Cotton Movement to Va. Ports.—During the 7 months of the 1880–'81 cotton-year from Sept. 1 to April 1, there were received at all U. S. ports, 5,058,444 bales, as against 4,468,549 for the same period of 1879–'80. Of the 1880–'81 movement 630,823 bales were received at Norfolk and 188,075 at City Point and West Point, or 818,898 bales at Virginia ports, very nearly 1-6th of the bales moved, and a larger quantity than reaches the ports of any other state except Louisiana (New Orleans). In the 1879–'80 movement for this period Virginia ports received 663,804 bales, or about 1–7th of the bales moved. The Virginia ports have received so far during the current year 145,094 bales more than they did for the same time in the previous one—a gain of about 22 per cent. Norfolk, which in 1865–'6 received only 59,096 bales, and was hardly called a cotton-port, in 1871–'2 received 258,730 and became the 5th U.S. port in rank, and in 1873–'4 received 472,446 and became 3rd in rank, a place she has since held, being surpassed by but Savannah and New Orleans, bids fair to become the 2nd in rank during the current year, taking position next to New Orleans in this trade of really magnificent proportions; for so far Savannah has received but 100,855 bales more than she did in 1879–'80, while Norfolk has received 174,381. In the direct export of cotton to Great Britain in 1880–'81 to date, Norfolk stands next to New Orleans, exceeding New York by 24,467 bales.

In 1865–'6 Virginia ports handled only about 1–38th of the cotton crop; now after the lapse of 15 years the "statement" indicates that they are handling about 1–6th of it.—A most remarkable growth, considering the keen competition there is between a dozen thriving commercial cities for this trade. The opening of highways to the great natural harbor of this continent is enabling it to assert its right to supremacy, and when these highways are properly lengthened and strengthened, as they soon will be, greatly, by the completion of the Chesapeake & Ohio to its eastern and western termini, and by its combination of the Norfolk & Western with lines penetrating all the west and southwest, then Virginia seaports will again become, by right of their inherent advantages, the leading ones of this country, as they were in former days.

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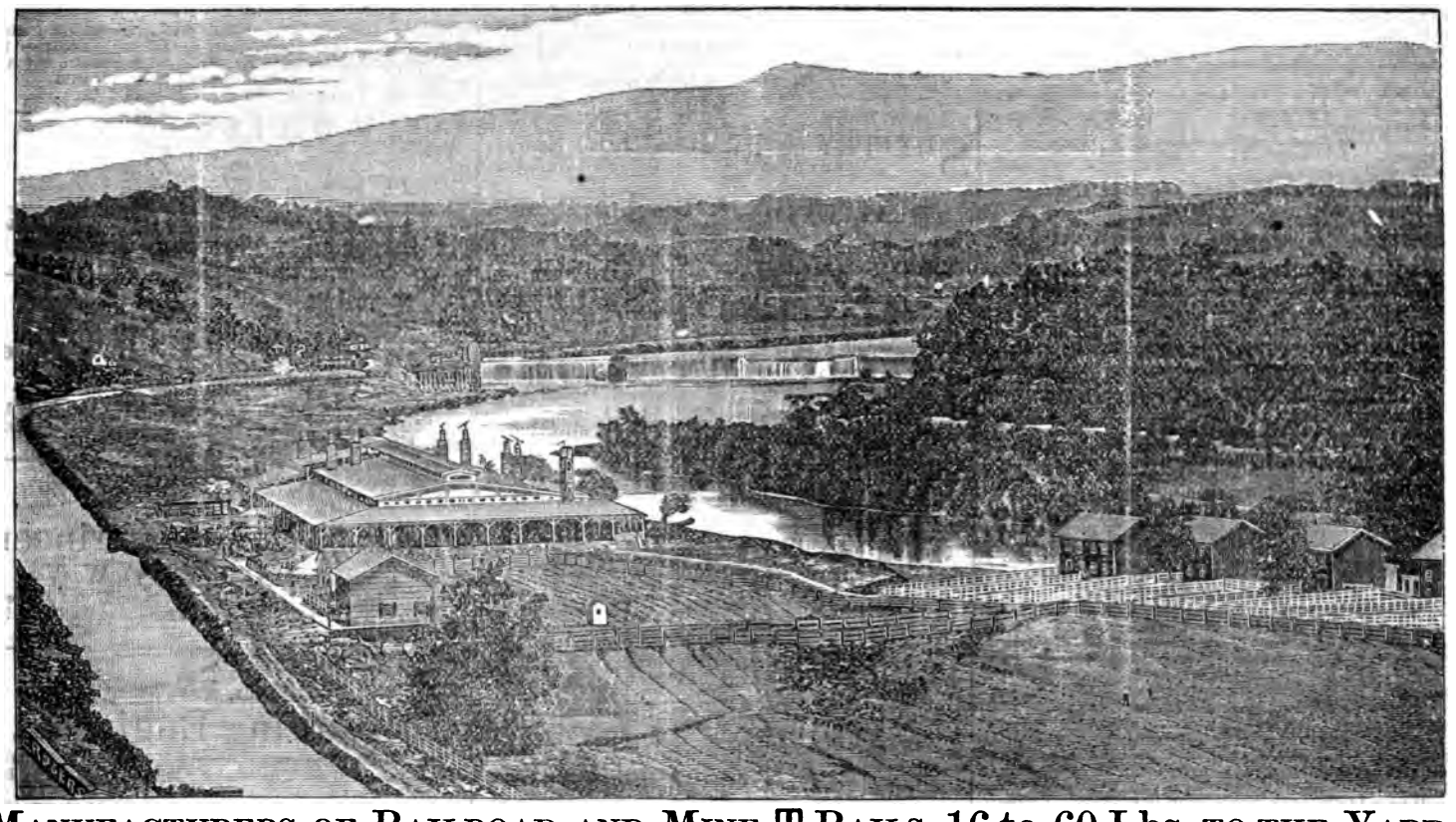

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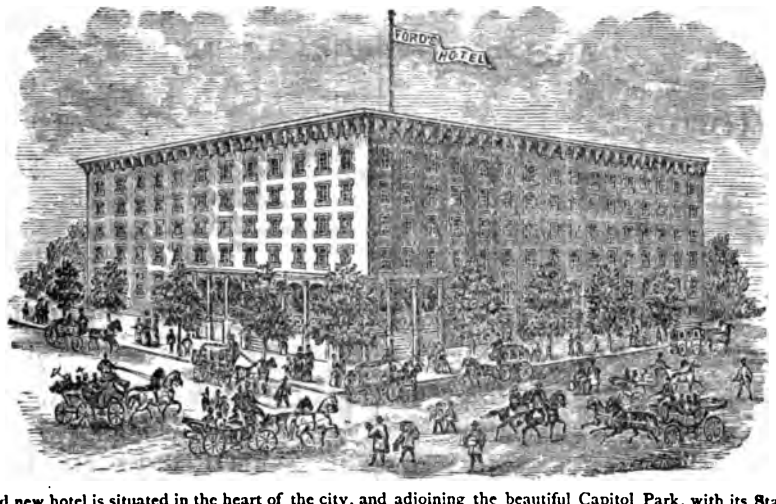

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By virtue of a decree of Nelson Circuit Court, pronounced at September term, 1880, in the chancery cause of Robinson &c. vs. Peters &c., the undersigned, as commissioners, will offer at public auction at New Market, in said Nelson county, on

Friday, May 13, 1881,

at 12 M., the real estate of Dr. Frederick J. Peters, known as "Sleepy Hollow" tract of land, about 3 miles below New Market, containing 1264½ acres. The said 1,264½ acres is a valuable mineral property, and is regarded by many as giving the strongest evidence of an unlimited quantity of iron ore, manganese, slate, marble and copper. About 300 acres is cleared and the remainder is in original growth. It lies within one mile of the R. & A. RR. with descending grade and right of way thereto. This property is looked upon as the most valuable mineral property that has ever been offered in this section of Virginia, and all persons desiring to purchase, are invited to examine. It will be sold either in whole or in part to suit bidders.

TERMS.—Cash enough will be required to pay costs of suit and sale, and for the residue, bonds with good personal security with waiver of homestead exemption, bearing interest from day of sale, and payable within one, two, and three years.

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The undersigned, as President of a Land Company, has for sale or lease, on favorable terms, some of the best coal and timber lands in the New River District, on the line of the Chesapeake and Ohio Railway. The coals on these lands are the **Coking Coals,** the coke from which is now so much in demand for blast-furnace and other metallurgical uses. For further information and terms, apply to

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As attorneys for the heirs, we offer for sale, on most reasonable terms, Lot "H" of the "Steele Survey," the Smithers-Gauley Tract, containing

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A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 5. } Staunton, Virginia, May, 1881. { Price 25 Cents.

The Virginias,

PUBLISHED MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor,

At 346 E. Main St., Staunton, Va.

Terms, including postage, per year, in advance, $2.00. Single numbers, 25 cents. **Extra** copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising, per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors.), complete, with index and title page, will be sent, by express or mail, prepaid, to any address in the U. S., *on receipt of Three Dollars.*

Attention is Invited to New Advertisements.—(1) The *Rockbridge Alum Springs* hotels, amid the mountains of Rockbridge county, Va., not distant from Goshen or Millboro stations of the C. & O. Ry.,—one of the most delightful and health-restoring of Virginia summer resorts, one that we knowingly recommend to the patronage of our numerous readers,—are now open for the reception and handsome entertainment of a large number of guests. Mr. William Frazier, a tried and approved master of the rare art of the good management of an extensive summer resort, invites, in this number, the afflicted by numerous diseases to a trial of the medicinal virtues of the widely known and authoritatively commended Rockbridge Alum waters, and the seekers after rest and recreation to "a home" for the summer at the extensive and modernly equipped and maintained hotels beside them. We especially recommend this resort to the large and constantly increasing numbers of people that find delight in lingering in regions rich in objects of geologic, botanic and scenic interest. It is a capital place from which to make explorations. The surrounding country abounds in mineral wealth.——(2) *Coal Lands* and a *Salt Furnace*, on the Ohio river in W. Va., offered for sale by D. H. Willard of Point Pleasant, W. Va. Investments in such properties are now proving profitable.——(3) *Specular Iron Ore Property* in the well known James River ore belt, is offered for sale by A. D. Robertson & Co., of Lynchburg, most trustworthy gentlemen, who are thoroughly well informed in reference to the mineral wealth of the region around them.——(4) *Mill and Factory Sites* in Danville, Va., a city that is one of the most thrifty in the land and that offers very great inducements for manufacturing, can be bought or leased by applying to E. E. Bouldin, Esq., of Danville, Va. *A Gold Mine* in N. C., in one of the best portions of the "gold-belt" of that state, can be bought from the same gentleman. We heartily commend him and what he offers to our readers.——(5) To Frank Prufer & Son's notice that they will do binding, backing and dissect maps, &c. There are no better workmen in America for such work—they do all ours.

Prof. J. J. Stevenson writes us that he has recently been making an examination of the coal beds of Tazewell Co., Va., and Mercer Co., W. Va. We are pleased to know that he is still at work along the Virginian border of the great coal basin of the Ohio, and hope the result may be another paper like the exhaustive one we have already published on the same border more to the southwest.—We would call the attention of our W. Va. people to his able paper on the coals of the N. W. part of that state the publication of which is begun in this number.

Prof. William B. Rogers will be detained at Boston by the closing exercises of the Mass. Institute of Technology, of which he is president, which occur June 3rd and 4th, putting it out of his power to attend the meeting of the Am. Institute of Mining Engineers. A letter of the 19th informs us that he "wishes most earnestly that he were able to be in Staunton at that time."

A school of technology, or at least the beginnings of one, the *Dispatch* wisely urges as one of the present imperative wants of Richmond if it would have and hold the educated labor that it must have if it proposes to become a first-class manufacturing city.

Prices of Minerals in Liverpool, Eng.—Mr. Geo. G. Blackwell, one of our highly esteemed advertisers, has favored us with a slip from his report of May 2, 1881, to the *Liverpool Journal of Commerce*, of prices of Minerals, Chemicals and Colors, from which we quote the following which are now or may be furnished from the Virginias.

Barytes: Carbonate, lump, 87s 6d; seconds 60s; common 50s. Sulphate: lump selected, 25s to 30s; first-class, 17s 6d to 20s; very good 15s to 16s; prime white, ground, 85s; first quality 70s; second, 50s; common, 40s.——*China Clay:* best, 42s 6d; good, 35s.——*Chrome ore*, very best £6 10s to £7.——*Asbestos:* Canadian £40; good strong long fibre £45 to £50.——*Calamine:* (zinc silicate) £5 to £6.——*Manganese:* steady (price not quoted).——*Plumbago:* £8 to £10; best quality, £15 to £20.——*Pyrites:* iron 5d to 6d per unit.——*Alum:* lump, £5 17s 6d; ground £6 15s.——*Ochre:* Oxfordshire, £9 7s 6d; Derbyshire, 40s to 50s; Devonshire, 50s to 70s.——*Umber:* Turkey, 57s 6d; Devonshire, 55s.

In reference to a sample of Va. ochre which we sent him Mr. Blackwell writes, May 5, "I think it will tally with most of the Oxfordshire."—He adds that he has noticed the change in rates to Philadelphia (a result of the opening of the Shenandoah Valley RR. we may say) and thinks that will help the development of our mines. *Antimony ore*, which he quotes at £16 10s to £17, he says is well worth attention; thinks there must be deposits of it here. Dana says it has been found sparingly at "Soldier's Delight," Baltimore county, Maryland.

Immigration.—Col. A. Pope, agent of the associated railways of Va. and N. C., is bringing into Va. and N. C. respectable and industrious German, Swiss and French immigrants and finding homes for them, where they can get employment, along the line of the railways he represents.—This is a common sense way of doing, one that all our railways would do well to imitate. The demand for labor is now very great and the negroes are disposed to go to the mines, quarries, furnaces, railways, etc., where they can work in gangs, leaving our farmers short of labor, thus opening the way for the introduction of these patiently laborious foreigners, greatly to the advantage of our state. The German steamers now bring large numbers of these immigrants every week to Baltimore, and they can be more readily turned this way than formerly when they all landed at New York.

The Iron and Steel Associat'n of Va., Rockbridge Co., Va., Mr. Wm. N. Page, financial agent, has just finished the survey of its lands, described in our last number, and on the 23d inst., Mr. C. W. Smith, C. E., of Richmond, Va., a graduate of the University of Virginia, began running lines for the contemplated railway from the C. & O. up Bratton run valley. Contracts for grading road-bed of railway, for bricks and other materials, have been closed, and by the time this reaches our readers the extensive operations contemplated by this strong company, as heretofore detailed in the THE VIRGINIAS, will be well under way.

The Richmond & Danville RR. now runs 3 trains daily each way, between Richmond, Va., and Atlanta, Ga., over its recently acquired and consolidated lines. Trains leave Richmond (from May 15) at noon, at 2:55 and 10:45 P. M., and arrive at Atlanta at 12:20 P. M., and at 10 and 12:05 A. M., respectively, of the following day. It also runs a passenger train daily from Richmond, at 9:30 A. M., that connects for Lynchburg with the Norfolk and Western. The noon train takes the New York and Atlanta, and the 10:45 P. M. train the Washington and Augusta Pullman cars.

Tobacco-farms,—says Dr. Pollard, the Va. Com'r of Agriculture, in a letter to the *Dispatch*—can be best improved by giving up tobacco culture and seeking some more profitable crops.—Our observations led us to the same conclusion long ago.

American Institute of Mining Engineers.

ANNOUNCEMENT OF THE VIRGINIA MEETING.

GENERAL COMMITTEE:

J. F. Lewis, - - - - - Quinnimont, W. Va.

COMMITTEE OF RECEPTION AT STAUNTON:

Maj. Jed. Hotchkiss, Chairman.

W. A. Burke, R. H. Catlett, J. F. Effinger,
M. E. Miller, W. J. Nelson, D. A. Kayser.

LOCAL COMMITTEE OF ARRANGEMENTS:

G. T. Wickes, Chairman.

G. W. Bramwell, Sec'y, S. F. Morris, S. M. Buck,
J. E. Johnson, C. A. Rundall, E. S. Hutcheson
H. Firmstone, Wm. N. Page, M. F. Maury,
F. Lyman.

PROGRAMME.

Monday, May 30th, 1880—Opening session in Staunton Opera House at 8 o'clock P. M.

Tuesday, May 31st—Session of the Institute at 9 o'clock A. M., at 3 o'clock and 7.30 o'clock P. M. At 1.30 P. M. an excursion will be made in carriages about the city, visiting the Water Works and Public Institutions. At 8.30 P. M. the Citizens' Reception, at the Music Hall of the D. D. & B. Institution will be attended.

Wednesday, June 1st—An excursion over the Shenandoah Valley Railroad, visiting the Shenandoah Iron Works, Luray Cave and other points of interest.

Thursday, June 2nd—Excursion over the Chesapeake and Ohio Railway, visiting Ferrol, Longdale, Clifton Forge, Low Moor, and arriving at White Sulphur Springs at 5.30 P. M. Session of the Institute at 8 P. M.

Friday, June 3d—Excursion over the Chesapeake and Ohio Railway to the New River coal fields, visiting Quinnimont, Stone Cliff, Fire Creek, Sewell, Nutallburg, and Hawk's Nest, where an opportunity will be given for a thorough examination of the Ansted or Gauley Mountain Coal Mines; then through the Kanawha coal fields to Coalburg, returning to White Sulphur Springs for the night.

Saturday, June 4th—Excursion over the Richmond and Alleghany Railroad from Williamson to Balcony Falls, visiting the Natural Bridge of Virginia and returning to Williamson in time to take the trains East and West.

Available trains from the North and West, making direct connection with Staunton are as follows:

Leave New York via Pennsylvania R. R. at 3.40 P. M. and 9.55 P. M.

Leave Philadelphia via Pennsylvania R. R. at 5.43 P. M. and 1.05 A. M.

Leave Washington via Virginia Midland R. R. at 10.00 P. M. and 7·10 A. M., connecting with Chesapeake and Ohio Ry. at Charlottesville and arriving at Staunton at 4.45 A. M. and 2.00 P. M.

By purchasing tickets via Baltimore and Potomac R. R. passengers avoid the transfer in Washington.

The 9.55 P. M. train from New York, with Philadelphia and Washington connections, runs daily.

Leave Pittsburg at 8.19 P. M. and arrive at Harpers Ferry at 4.36 A. M.

Leave Wheeling at 5.25 P. M. and arrive at Harpers Ferry at 4.36 A. M.

Trains leave Harpers Ferry via Valley Branch of B. & O. 11.15 A. M. arriving in Staunton at 4.50 P. M.

Arrangements will be made to run Sleepers through to Staunton.

Reduced rates of fare have been obtained from the Baltimore and Ohio Railroad from points on its line and it is expected that arrangements will be completed for reduced rates on other roads.

It is necessary that members should inform the Secretary of the Institute promptly of their intention of being present at the Staunton meeting, in order that certificates may be sent to them for the purchase of such excursion tickets as may be issued by the different railroad companies, and also that the accommodations may be prepared for their comfort during the meeting.

Members are requested to give early notice to the Secretary of the papers they intend to present at this meeting, that they may be announced in a subsequent circular. It is expected that the discussion on Steel Rails, begun at the Philadelphia meeting, will be continued.

THOMAS M. DROWN,
Easton, Pa., May 6, 1881. Secretary.

Correspondence.

MAJOR JED. HOTCHKISS:

My Dear Sir—I beg leave to communicate to you a fact which I am sure will be gratifying to you as furnishing a strong evidence of the valuable service which your paper (THE VIRGINIAS) is rendering to the state of Virginia.

Some months ago, at your request, I prepared a short article for THE VIRGINIAS, in which I spoke of the organization, at the University of Virginia, of the new school of Geology and Mineralogy, which was endowed by my friend Mr. W. W. Corcoran of Washington City, and made some remarks on the necessity of making important changes in the system of instruction in the colleges and universities of the state, with a view to giving greater prominence to physical science.

When I wrote that article I thought it would probably be interesting to the people of Virginia, as an exposition of the views and purposes of the present Rector and Visitors of the University, but, to my surprise, I have found that it has attracted attention and elicited commendation in quarters where I had no reason to anticipate that it would ever be read or heard of.

Within a few weeks after my communication was published, I received two letters, from points *six thousand miles apart*, in which the writers spoke of the pleasure which they had respectively derived from reading it, and each tendering to the University of Virginia, through me as its Rector, a present of a valuable collection of minerals and geological specimens.

The first was from Mr. Hunter, of California (a native of Virginia), who, after referring to my article in gratifying terms, stated that he had for years been engaged in making an extensive collection of minerals, crystals, fossils, &c., which he would be happy to present to the University of Virginia, as an addition to its already splendid museum of natural history, presented by the late Mr. Lewis Brooks, of Rochester, N. Y.

The second letter was from Mr. George G. Blackwell, of No. 26 Chapel street, Liverpool, an eminent merchant of that city, who deals largely in all kinds of mineral substances, ochre, chalk, kaolin, manganese, umber, &c. He also expressed himself in complimentary terms, and made a similar tender to the University of a handsome collection of ores, &c., from almost every country in the world. He adds, "I am quite convinced there is a great future before Virginia."

Mr. Blackwell's collection was received on Friday, 15th inst., and was forwarded by me to the University on Saturday, and I am in daily expectation of the arrival of Mr. Hunter's collection.

I was gratified to learn that your paper had obtained so wide a circulation, as it was through its columns that these gentlemen became advised of the "new departure" which had been organized at the University of Va.

Permit me, in conclusion, to express the hope that THE VIRGINIAS may long continue to be the medium through which the vast physical resources of Virginia may be made known to the people of our sister states and of foreign countries. It certainly offers many inducements to those who wish to advertise valuable properties for sale.

Very truly yours, &c.,

ALEX. H. H. STUART.

Staunton, Va., April 10th, 1881.

The Mineral Traffic of the Atlantic, Miss. & Ohio RR., now the Norfolk & Western, for Jan., Feb. and March, 1881, the first quarter of the year, kindly prepared for THE VIRGINIAS by Col. E. E. Portlock, auditor of that railway, was as follows, in tons of 2,000 pounds. (The traffic for the preceding quarter, the last of 1879, was given on p. 29 of Feb., 1881, No.)

1. VIRGINIA METALS AND MINERALS TRANSPORTED.

Pig iron, 2,744 tons carried; 1,047 in Jan., 757 in Feb., 940 in March. Its destination was, 25 tons to Boston, 202 to New York, 1,060 to Philadelphia, 561 to Baltimore, 47 to Lynchburg, 17 to way stations, 426 to Richmond, 2 to Rich. & Dan. RR., 112 to outside lines *via* City Point, and 292 to Southern states.—The increase over the preceding quarter was 357 tons, or over 15 per cent. A notable feature is the large increase, over 100 per cent, in the quantity destined to Philadelphia, probably the iron of the Lobdell Car-wheel Co. of Wilmington, Del., that now owns and operates several of the S. W. Va. furnaces. To Richmond the increase was over 264 per cent, and to the Southern states nearly 90 per cent. The wide range of the markets for this pig iron, all charcoal, shows its high character and the demand that there is for it. We are confident that nowhere in the country can charcoal pig be more advantageously made than along the Blue Ridge side of the Great Valley.

Iron ore, 3,097 tons carried; 1,161 in Jan., 1,308 in Feb., 628 in March. It went, 2,031 tons to Lynchburg, 1,066 to outside lines *via* City Point.—Only 215 tons were carried in the preceding quarter, all but 1 ton to Lynchburg. The ore of this quarter to Lynchburg was for its new furnace, most of it probably from the Ironville mines, in Bedford.

Zinc spelter, 146 tons carried; 61 in Feb., and 85 in March. New York received 113 tons and Philadelphia 11. The quantity sent the preceding quarter was but 10 tons, so the increase is a handsome one. All the Va. spelter is from the Bertha Zinc Works, at Martins, Pulaski county.

Zinc ore, 1,067 tons transported; 624 in Jan., 263 in Feb., and 180 in March. New York received 1,056 tons and Baltimore 11. During preceding quarter only 94 tons were shipped.

Pig lead, 21 tons carried; 11 in Jan. and 10 in March; all to Boston. A large falling off from the 163 tons of previous quarter.

Lead ore, 10 tons were transported, in Jan., for New York.

Copper ingots, 21 tons were carried, in Feb., for New York.

Barytes, 965 tons carried; 359 in Jan., 228 in Feb., and 378 in March. Boston received 72 tons, New York 482, Philadelphia 348, Baltimore 26, and Southern states 37.—The increase in the traffic for the quarter was about 80 per cent.

Limestone, 810 tons transported, 214 in Jan., 300 in Feb., and 296 in March, all to Lynchburg; probably from The Valley for the Lynchburg blast-furnace.—This is a new traffic, one that must in time become a large one.

Plaster; 2,256 tons were carried; 91 in Jan., 547 in Feb., and 1,618 in March, the quantity increasing with the approach of spring. Way stations received 746 tons, Rich. & Danville RR. 10, and Southern states 1,500. This comes from the Holston beds at Saltville, Washington and Smyth counties.—Only 89 tons were moved in the last quarter of 1880. A large increase in this trade will come when the Shenandoah Valley RR. is completed to a connection with the Norfolk & Western.

Coal, 1,789 tons were transported; 679 in Jan., 599 in Feb., and 511 in March. Lynchburg received 47 tons; the remainder went to way stations.—This coal was all mined from the Montgomery coal measures, No. X or Lower carboniferous.

Salt, 793 tons were moved; 219 in Jan., 308 in Feb., and 266 in March. Way stations took 90 tons, the other 703 went to Southern states. There was the usual heavy falling off incident to the season demands.

The aggregate metal and mineral tonnage from Va. for the quarter was 13,719 tons, against 8,942 for the preceding quarter; a gain of over 53 per cent.

We hope Col. Portlock,—who, we are pleased to know, will continue to fill the same office under the new management,—will hereafter give us the *stations from which* each article of this traffic is sent, and so make our "probabilities" of place "certainties." An improvement in this report over former ones is the separation of ores into kinds.

2. METALS AND MINERALS FROM BEYOND BRISTOL.

The metal and mineral traffic from beyond Bristol, most of it probably from Tenn., amounted to 1,305 tons, against 2,834 for the preceding quarter; a falling off of nearly 115 per cent. The Jan. carriage was 350 tons, the Feb. 393, and the March 562. There were transported 150 tons of *coal*, 126 of *pig iron*, 625 of *marble* and 404 of *manganese*.

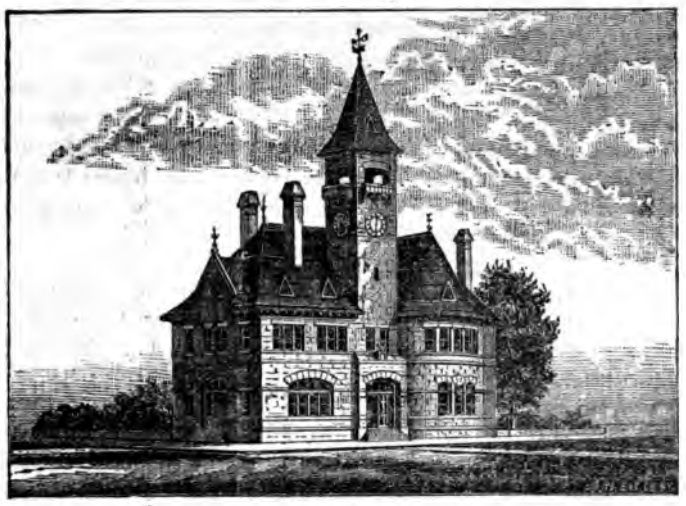
Low Moor Furnace, Va.—Our last report of current operations at the furnace of the Low Moor Iron Co. of Va., Alleghany county, published in March No, was to March 12th, the 140th day of the present blast. From March 13th to May 1st, 141st to 189th day of work of this furnace, including about 6 days of stoppages, the output was about 3,866 tons of pig iron, of various grades, mostly Nos. 1 and 2, and mill, from some 3,115 tons of lump and 6,232 tons of wash ore, in a total of 9,347; with a consumption of about 4,619 tons of coke, 329 tons of coal (for the boilers), and 4,627 tons of limestone. The average cost of labor was about $1.80 to the ton made.—The total output of this furnace to May 1st, 1881, during the 189 days of this its first blast, was 13,086 tons; an average of 70 a day, including all stoppages.

The entire pig iron business of Cincinnati for the commercial year ending Aug. 31, 1880, was represented by a movement of 248,815 tons, (Report of Chamber of Commerce, p. 161); a quantity but 19-times that made at Low Moor from Oct. 11, 1880 to May 11, 1881

Tobacco vs. Other Crops.—The Lynchburg *Advance* says "the planters of Va. and N. C. can no longer rely on their industry and skill and the seasons for high prices. White Burley with white sugar syrup or molasses, or licorice and many drugs and some barytes, perhaps, is pressing for the place formerly held by sun-cured Oronoco," etc.——"In all Va. warehouses there is seen a large quantity of tobacco, called nondescript, hardly paying cost, which warns us that we must be up and doing. Reduce the area of tobacco," etc.——"Diversify your crops. In S. Va. cotton is profitable with fertilizers, and in other places stock can be increased, others fruit—some all things."—Correspondents of the *Richmoud Dispatch* urge the cultivation of cotton in place of tobacco in Va. One of them who is familiar with cotton growing, says, "some of the most productive cotton-fields and the finest upland cotton is grown *in the most Northern limit of the cotton-growing sections*" and that in England and the North "preference is given such cotton over the same grade grown in the Gulf States." The use of commercial manures, he states, "*forces* the earlier maturing of the crop and *improves the staple*." Attention is called to the fact that along the line of the Piedmont Air-Line RR. within a few years, lands that were considered almost valueless, are now producing splendid crops of cotton and the whole region is prosperous; a statement the Editor can verify from his own observations made in N. C. for the past three years. The writer referred to very properly calls the raising of more cotton in Va. in place of tobacco--a "sound policy."

Sale of Iron Lands.—The "Stack" farm of 1,000 acres, on Dunlap creek, Alleghany county, Va., near Backbone station of the C. & O. Ry., 215 miles west from Richmond and 18 miles west from Low Moor, including the "Stack" iron ore beds, was sold May 4th, to E. H. R. Lyman of New York, and Geo. T. Wickes and Frank Lyman of Low Moor, Va., of the Low Moor Iron Co. of Va., for $25,000. The Low Moor Co. is now obtaining from 10 to 15 car loads of ore from these mines daily, wagoning the ore about 2 miles from the mine to Backbone; surveys are being made for a branch railway to the mine; Mr. W. H. Sadler, who has hitherto worked this mine, taking from it some 8,000 tons of ore from Jan. 1st, 1880, to May 4th, 1881, will continue to superintend it for the purchasers.—This purchase does not mean that there is any lack of ore at Low Moor, but that the ore requirements of this great furnace demand a larger working face than it has available at this time; besides the investment is a good one.

The Iron Age, of New York, is the most valuable journal of its kind in America; its value would be greatly increased if it would be more particular in crediting its cotemporaries when it makes use of their work, to localize facts, if for no weightier reason.



New U. S. Court-house and Post-office, Charleston, West Virginia.

Above we give an engraving, from the design of Jas. G. Hill, U. S. Supervising Architect, of the new building which the United States Government is now erecting at Charleston, Kanawha county, West Virginia, for a Post-office and other Government offices below and a Court Room and clerk's, marshal's and jury rooms above. Congress, in April, 1880, made an appropriation of $75,000 for the construction of this building. It is located on Capitol street on a large lot extending through to Summers street, the site being a rise from which the ground slopes. The building is about 60x90 ft. and has two fronts; it will appear to be higher than the cut shows it. The material used is a beautiful gray coal measures sandstone, quarried near the city. Mr. Kemple, the architect in charge of the improvement of the State capitol, has immediate charge of the work on this building, under Supervising Architect Jas. G. Hill.

American Institute of Mining Engineers.

VIRGINIA MEETING, MAY, 1881.

THE FOLLOWING PAPERS HAVE BEEN ANNOUNCED:

Address by President Wm. Metcalf, Pittsburg, Pa.

The Ore Knob Copper Process, by Prof. T. Egleston, New York City.

The Hydro-metallurgy of Copper and its separation from the Precious metals, by Dr. T. Sterry Hunt, Montreal, Canada.

The Foreign Substances in Iron and their Combinations, by F. L Kleinschmidt, St. Louis, Mo.

Notes on Gold Mill Construction, by A. J. Bowie, Jr., San Francisco, Cal.

Index to American Engineering Articles and Papers for 1880, by Prof. H. S. Munroe, New York City.

The Geology, Mineral Resources and Industries of the Virginias, by Jed. Hotchkiss, Staunton, Va.

The Practical Working of the Ammonia-Soda Process, by O. J. Heinrich, Drifton, Pa.

The New Westmoreland Shaft, by W. P. Little and T. B. Stearns, New York City.

A Volumetric Method of Estimating Manganese in Pig iron and Steel, by F. H. Williams, St. Louis, Mo.

Filtering in Industrial Operations, by P. Barnes, Springfield, Ill.

Observations on some Ores of the Upper James River, by Prof. P. Frazer, Philadelphia.

Rich Hill Iron Ores, and the Falling Cliff Zinc Mine, by F. P. Dewey, Chattanooga, Tenn.

On the Solution of Pig-iron and Steel for the Determination of Phosphorus, by N. H. Muhlenberg and T. M. Drown, Easton, Pa.

The Occurrence of Black-band Iron Ores in West Virginia, by S. P. Sharples, Boston, Mass.

The Electrolytic Determination of Copper and the Formation and Composition of so-called Allotropic Copper, by J. B. Mackintosh, Hoboken, N. J.

Blast-furnace Hearths and Linings, by John Birkinbine, Philadelphia.

Discussion on Steel Rails, by Rich. Akerman, of Stockholm, Sweden, C. P. Sandberg, London, and others.

THOMAS M. DROWN,

Easton, Pa., May 23, 1881. Secretary.

Virginia Meeting, American Institute of Mining Engineers.

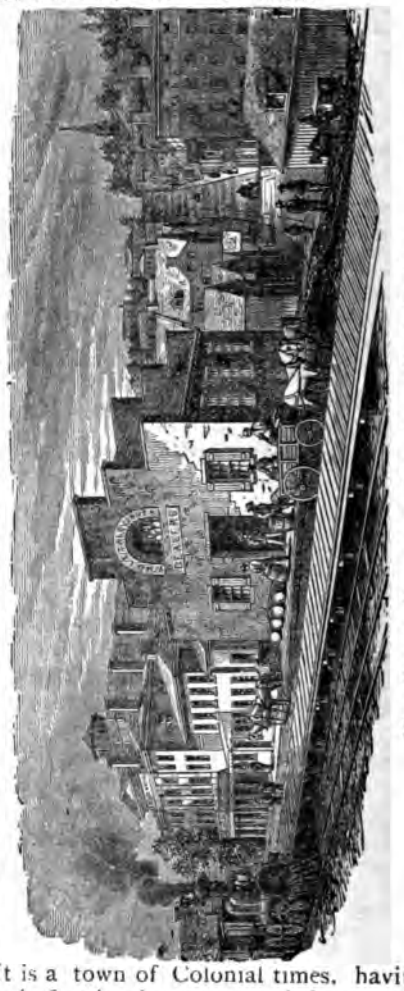
EDITORIAL NOTES ON PLACES, ETC., TO BE VISITED.

Early in 1880 the City Council invited the American Institute of Mining Engineers to hold one of its meetings in Staunton. At the Philadelphia meeting, last February, that invitation was accepted and it was decided to hold the "spring" meeting for 1881 in Staunton. According to the programme, published on page 66, this meeting will begin on Monday, May 30th, in the Opera Room of the City Hall, at 8 p. m., when the Mayor of Staunton, Hon. W. L. Balthis, on behalf of the City Council, and the Hon. Alexander H. H. Stuart, on behalf of the Citizens of Staunton, will welcome the Institute to our city and its hospitalities,—a welcome that will be responded to probably by Mr. William Metcalf, of Pittsburg, Pa., President of the Institute.

The programme provides for business sessions in Staunton at 8 p. m. of May 30th, and at 9 a. m. and 3 and 7.30 p. m. of May 31st.—These sessions are open to the public. We print elsewhere a list of the papers that to May 23rd have been announced to be read and discussed at this meeting. The order in which these and other papers will be read at Staunton and at the White Sulphur will be announced in programmes issued on Monday, May 30th.

Taken in the order in which places will be visited we will now give some notes concerning these places and objects of interest passed in going to them.

Staunton, where this Virginia meeting of the Institute is held, is the county seat of Augusta county, one of the largest in Virginia,—a county that formerly, in 1738, extended from the Blue Ridge to the Mississippi, embracing the present states of West Virginia, Kentucky, Ohio, Indiana and Illinois, within its limits.



New Street, Staunton, Va., from C. & O. Ry.

The location of Staunton is on Lewis creek, one of the sources of the Shenandoah, in the upper portion of the Shenandoah Valley part of the elevated grand division of Virginia lying west of the Blue Ridge and between it and the North or Kitatinny mountains, known as the The Valley of Virginia, a valley that in turn is part of the Apalachian Valley that extends, under various names, from the mouth of the St. Lawrence to Alabama. The city occupies a hill-and-dale portion of The Valley and the range of altitude within its limits is from 1,350 feet above tide at the Valley RR. station to 1,600 feet at the reservoir. It is centrally placed in reference to Virginia and West Virginia, 200 miles in air-line distance from the Atlantic at the Capes of Virginia to the southeast, and 200 miles from the Ohio at the West Virginia-Kentucky corner, at Big-Sandy-mouth, on the west. Staunton is at the crossing of the Valley RR. of the B. & O. and the Chesapeake & Ohio Ry. It is a town of Colonial times, having been laid out 132 years ago; in fact its site was occupied very soon after the discovery of The Valley in 1716. Its present population is over 8,000, although the census of 1880 gives it but 6,665; a discrepancy readily understood when the statement is made that the population, on all sides, spreads beyond the city limits, which have not been enlarged for many years. In 1860 its population was 3,875, in 1870 it was 5,120.

Geologically, Staunton is on Chazy and Trenton rocks. Cambrian and Siluro Cambrian, Rogers' formations II and III. Its hills are mainly sustained by the cherty beds of No. II. The lower portion of the city is on a Quaternary marl deposit rich in organic remains. Below the town excellent slates for flagging, marbleizing, etc., are quarried from No. III, and in the same direction are excellent quarries of limestone.

On Tuesday, May 31st., the members of the Institute will be ta-

ken, in carriages, around the city, visiting the two noble State charities, the Western Lunatic Asylum and the Institution for the Deaf, Dumb and the Blind, located here; driving by the four female colleges, the Presbyterian, the Episcopal, the Methodist and the Lutheran, institutions of learning that, frequented from nearly all the states of the Union, are pardonably the pride of the city; visiting the Federal and Confederate cemeteries; concluding with a view of the magnificent panorama of the Upper Shenandoah Valley as displayed from the reservoir of the Staunton water works, 1,600 ft. above the sea level.

From the summit of the reservoir the beholder sees fully 50 miles of the N. E.-S. W. length of the upper part of the Shenandoah Valley, (all the portion that will be traversed during the excursion to Luray.) The Blue Ridge,—constructed of Archæan rocks in its easterly and higher portion and of Primordial in its westerly, or lower one,—bounds the view on the southeast, ranging in altitude, where seen, from 1,966 to 3,886 ft. On the west are the successive echeloned ranges of the Little North and the Great North mountains of the Apalachian system—the Kitatinny ranges of the Indians—mountains built of formations II. to X., (Middle Cambrian to Lower Carboniferous), rich in iron ores and marbles, and having small anthracite coal-fields, ranging in elevation from 2,000 to 4,500 ft., culminating in Elliot's Knob, seen to the south of west, on which, over 4,000 ft. above the sea, is the head spring of the Shenandoah, Indian for "Beautiful daughter of the stars." Between these mountain systems undulates the greatly varied plateau valley of the Shenandoah, here from 20 to 30 miles wide—a fertile region carved from Lower Silurian rocks. In the northeast is seen the detatched Massanutton chain of mountains, an outlier of the Apalachians—made from Siluro-Cambrian and Silurian rocks, II. to VII, rich in iron ores—that rising to from 1,000 to 1,500 ft. above The Valley divides into two for some 50 miles: a chain that played a most important part in the strategic operations of the war of 1861-5, which have made this Valley famous.

D. D. & B. Institution, Staunton, Va.

Tuesday evening, at 9 p.m., the members and their friends will attend a musical reception, in the Music Hall of the D. D. & B. Institution, given them by the citizens of Staunton. The "Stonewall Brigade" Band—the one that followed the fortunes of "Stonewall" Jackson's own old brigade—will enliven the welcome with its music.

That our readers who do not attend this reception may see how our gifted local amateur artist, Gilbert R. Frith, Esq., symbolizes Virginia's new era, in which our guardian genius lays aside the panoply of war and becomes the genius of industry under whose guidance our mineral wealth will flow in streams that will solidify into "Prosperity" and "Happiness," and enable the knights of the "Iron Horse-shoe," of to-day, legitimate successors of those of the "Golden" one, to continue through all the years to come the substantial "Welcome" that Virginia always extends to her guests, we reproduce for them the card of invitation.

Excursion by the S. V. RR. to Luray.

On Wednesday, June 1st, by invitation of the Shenandoah Valley Railroad Co., the Institute will make an excursion over the portion of that railway between Waynesboro and Luray, including the stations of the following table:

Shenandoah Valley Railroad Stations.	County and State.	Miles from Waynesboro	Feet above Tide.
Waynesboro	Augusta, Virginia.	....	1 284
Crimora	" "	6.8	1,242
Patterson	" "	11.6	1,135
Weyer's Cave	" "	14.6	1,123
Port Republic	Rockingham, "	16.5	1,096
Elkton	" "	31.2	958
Shenandoah Iron Works	Page, "	37.0	940
Grove Hill	" "	39.7	966
East Liberty	" "	41.8	946
Marksville	" "	48.1	1,066
Luray	" "	54.9	822

Leaving Staunton at an early hour in the morning the ride for 12.5 miles is over the Chesapeake & Ohio Railway, by the courtesy of that road, to Waynesboro, the crossing of the C. & O. Ry. and the S. V. RR. From just beyond Staunton for some 6 miles, to near Fishersville, the railway is in the Utica slates, shales, etc., which are deeply trenched by Christian's creek, crossed about midway. At Fishersville the Trenton limestone, where it is used and found exceptionally good for lime-burning, is entered and continued in to Waynesboro.

Iron ore of excellent quality abounds on the flanks of the cherty hills of No. II, S. W. from Fishersville. From the beds in sight of the station a considerable quantity of ore has been taken; ore containing 55 per cent metallic iron, 0.240 phosphorus, 5.76 silica and 13.62 water, by analysis by Prof. J. W. Mallett.

The park-like *oak forests* of the Valley, samples of which are seen between Fishersville and Waynesboro, are worthy of attention as illustrating how, from the operation of natural causes, when left to themselves, our country may be converted from an open to an afforested one, contrary to much that has been written on this subject. When this Valley of Virginia was first occupied, about 160 years ago, as we know beyond question, it was an open prairie-like region, covered with tall grass on which fed herds of deer, buffalo, elk, etc., and having no timber except on the ridgy portions of it. In consequence of its settlement the annual fires were prevented, and, as from one great seeding, forests sprang up over the whole region, which, now, as uniform as a grain crop, husbanded by the care of five generations of thrifty farmers, cover a large proportion of the surface with hardwood trees of superior excellence.

Waynesboro is on the South river of the South fork or main-Shenandoah, near the junction of Potsdam slates with Trenton limestones. Beds of excellent ochre may be seen in the cut near the station. The western foot-hills of the Blue Ridge, just across South river, the Primordial ribs along the shore line of the old westward-stretching Silurian sea, abound in iron ores, specular and limonite, ores of Rogers' No. I, partially developed at the Davidia and at the Mike's Knob mines, in sight; the specular, by Wuth's analysis, containing 41.41 metallic iron with .070 of phosphorus.—Waynesboro is now a thrifty manufacturing village, one that, with the facilities it will soon have as the crossing place of two great railway systems, will before long become a thriving manufacturing town.-Its Virginia split-bottom and -back oak chairs, such as Garner & Myers make there, are so comfortable we cannot forbear to mention them in this connection; our labors are lightened by using one of them.

Crimora, the *manganese station*, is reached soon after leaving Waynesboro; there Capt. W. A. Donald ships the "crude," "granulated" and "ground" manganese ores, that his Crimora company mines from the Potsdam slates at the foot of the Blue Ridge near by. From these mines there were shipped 22 tons of manganese in 1875; 227 in 1876; 1,368 in 1877; 1,294 in 1878; 1,926 in 1879; 2,552 in 1880; and 880 tons to this date, in 1881. The manganese here mined is of a superior quality; most of the product is marketed in Liverpool.

The battle of Piedmont was fought, June 5, 1864, some 3 miles west from Patterson station. The *Black-rock springs* and a most remarkable display of broken Potsdam sandstones are in the Blue Ridge to the east.

Weyers Cave, at the station of the same name, is one of the most remarkable limestone caverns known; the descriptions of its growth by Prof. Wm. B. Rogers, who studied it for many years, and the sketches of its wonders by "Porte Crayon," published in Harpers,' one of which we reproduce, have made it famous. A day cannot be more delightfully spent than in wandering through its mile of naturally richly ornamented apartments. In the same hill are Madison's cave and the Cave of the Fountains.

Mount Vernon forge, opposite Weyer's Cave, was a flourishing manufactory of charcoal blooms and bar-iron, from 1810 up to the great flood of 1870, that swept it away. A few miles east, in Brown's gap of the Blue Ridge, the opening of which is in sight, is Margaret-Jane, or Mount Vernon blast-furnace, built in 1849 and used in making charcoal pig-iron up to a few years since. For nearly 20 miles, from Patterson to Elkton, the whole western slope and the foot-hills of the Blue Ridge, many square miles of land, pertain to this furnace and forge, the whole constituting an extremely valuable iron property, belonging to the Abbot Iron Co. of Baltimore,—a property that will doubtless soon be utilized again, now that it has railway communication to coke and to market.

[CONTINUED ON PAGE 72.]

Notes on the Geology of West Virginia.

By Jno. J. Stevenson.

Professor of Geology in the University of New York.

(*Read before the American Philosophical Society, February 5th*, 1875.)

During July and part of August, 1874, I made a reconnaissance of a portion of West Virginia lying between Rich mountain and the Ohio river. In this area are included parts of Randolph, Upshur, Harrison, Lewis, Doddridge, Ritchie and Wood counties. To connect this work with that reported in my previous paper, I made some examinations in Taylor and Marion counties.

This whole region has suffered much from erosion, and its surface is a confused mass of hills and ravines apparently without system. In the eastern portion, that drained by the forks of the Monongahela river, the valleys are usually quite broad and the hills are rounded except in the vicinity of Rich mountain, where, owing to the increasing dip, the slopes become quite sharp. In this drainage area the main streams flow across the dip, whence result the broad valleys and gentle slopes observed on Tygart, Buckhannon, and the west Fork rivers. On the west side of the divide, separating the Monongahela from Hughes river on the Little Kanawha, the conditions are different. The streams flow, for the most part, with or opposed to the dip, so that one finds the country abrupt and the valleys narrow until he approaches the Ohio.

Between Rich mountain and the Ohio the soil is not very rich, owing to the comparatively small quantity of limestone present. In portions of Randolph and Upshur counties, however, there is much rich land along the "bottoms," the alluvium being in a measure derived from the lower carboniferous rocks. The western portion of the area is very lean, as the soil has resulted simply from disintegration of the Upper Barren shales or sandstones, or in other localities from similar disintegration of the red argillaceous shales of the Lower Barren group. It is said that in Doddridge, Ritchie and Wood counties, there is comparatively little land rich enough to yield 40 bushels of corn per acre.

Over the greater portion of the area, the hills are covered by a dense growth of valuable timber, consisting chiefly of poplar (tulip tree), red and other oaks, chestnut, beech and maple. The oak and poplar are quite valuable. At the west, much of this timber is floated to the Ohio by way of the Little Kanawha, not a little of it being sent down as single logs from the smaller tributaries. The magnificent timber on Rich monntain will soon be available, as the obstructions in Buckhannon and Tygart rivers are to be removed, so as to open the way to Grafton, where immense sawmills have been erected.

The availabilities of the country have not been fully tested, and for the most part it is thinly settled. Such of the inhabitants as have means, devote themselves to raising stock or wool, while the poorer classes are wasting their substance by cutting the fine timber into staves or shingles.

Throughout this whole region, evidences of drift are entirely wanting. The superficial deposits are thin except at the east, where the debris on the hills is so thick as to render satisfactory tracing of the strata almost impossible. Along the northwest branch of the Baltimore and Ohio Railroad, one finds frequent proof of the deepening of waterways, for on top of many hills, 75 to 100 feet above the present streams, there occur fresh-water shells similar to those now living in the creeks.

Rich mountain is the western slope of a great anticlinal ridge, whose eastern slope is known as Cheat mountain. Between the two mountains is the anticlinal valley of Tygart river, whose scenery can hardly be excelled. Along the central line of this valley the dip of the strata is nearly 65° northwest and somewhat less southeast. Taking the Staunton pike westwardly, we find the dip diminishing, so that on top of Rich mountain it is only 18°. Thence the decrease is very rapid, and at Roaring creek the strata are almost horizontal. This condition continues for nearly twelve miles along the pike; after which the northwest dip is resumed, now 120 feet to the mile, and is retained until about two miles west from Buckhannon. There it is reversed, and we meet the anticlinal fold of Laurel hill. The plane of this axis crosses the pike about three miles west from Weston, and there the dip is again toward the northwest at the rate of nearly 150 feet per mile. This rate continues for about 20 miles, beyond which the strata become almost horizontal. The Laurel Hill anticlinal crosses the railroad not far from Flemington, and the flattening of the strata begins near Long Run station 30 miles farther west.

About one-eighth of a mile east from Ellenboro and 45 miles west from Clarksburg, a sharp fault occurs, on whose eastern side the rocks dip almost due east at an angle of 26°, while on the western side the strata are horizontal. The exact line of fault is not exposed, and there is an interval of 70 feet concealed between the points of observation. The approximate horizontality continues westward to within a mile of Petroleum, where the dip becomes eastward and rapidly increases, followed west, until just west from that station it becomes 36°. From this point almost to Laurel Junction somewhat more than one mile, the dip is very confused, but a shattered anticlinal can be traced, the rocks meanwhile dipping east or west, as the case may be, at from one to five degrees. Near Laurel Junction the dip becomes five, ten, twenty, forty or even seventy-five degrees westward. In the cut immediately west from that station the rate decreases to five degrees within a space of 6 feet horizontally, and soon after falls to only 10 feet per mile. Beyond this to the Ohio the rocks remain almost horizontal.

The section obtained in passing from Rich mountain to the Ohio embraces the whole of the Upper Carboniferous as found in West Virginia, and if begun on the east slope of the mountain, includes also a very large portion of the Lower Carboniferous. The anticlinal valley of Tygart river is cut out of the Lower Carboniferous series, which is well exposed on each wall to the crests of the mountains. On top of Rich mountain we find the Great Conglomerate forming the crest throughout Randolph county. On the western slope of the ridge are the Lower Coals, which pass under the surface before reaching the Buckhannon river in Upshur county. The Lower Barren Group is well exposed toward the foot of the mountain near Roaring creek, and thence westward in the bluffs for nearly forty miles; but, owing to the flattening of the dip near Roaring creek, it is the surface series for only a few miles in the area examined. Northward from the Baltimore and Ohio Railroad, or, better perhaps, at the State line, the Upper Coal Group finds its eastern outcrop several miles from Laurel hill, but followed southward this outcrop is seen approaching the crest of the axis until near the railroad it crosses it. Along our southern line the fold becomes very gentle, so that the Pittsburg crosses its crest and has its outcrop nearly 25 miles east from it. The eastern boundary of the group is very tortuous. The Upper Coals extend westward almost to the line of the Ellenboro fault, where the Lower Barren Group is thrust up. This continues to the especially disturbed area known as the "Oil-break," in which the Lower Coal Group is exposed. Beyond the "break" to the Ohio river the only rocks exposed are those of the Lower Barren. The region lying west from the Ellenboro fault will be described separately.

The Upper Barren Group is cut off by the Ellenboro fault, but eastward from that for nearly twenty miles its rocks are those covering the surface, those of the Upper Coal Group being found only in the deeper ravines.

The Coal Measures.

In this paper the terms, Upper Barren, Upper Coal, Lower Barren, and Lower Coal, as designations of the several groups into which the Coal Measures are naturally divided, are precisely in the same sense as in my previous paper.

Upper Barren Group.—This group which includes all the rocks above the *Waynesburg Coal*, covers a large extent of territory, whose western line is the Ellenboro fault. The eastern outcrop is an ill-defined line, passing a little west from Troy, in Gilmer county northward, and coinciding almost with the western line of Lewis county. It crosses the Northwestern Railroad near Wolfe Summit, 8 miles from Clarksburg, and running irregularly northeast, reaches the Baltimore and Ohio Railroad about 3 miles north from Fairmont, passing finally into Pennsylvania nearly 4 miles west from the Monongahela river.

The northwestern boundary in West Virginia is a line passing from the Pennsylvania border near the junction of Ohio and Marshall counties, West Virginia, to a little below Moundsville, on the Ohio river. This is the overlying group in Doddridge, Tyler and Wetzel counties, as well as in the eastern half of Ritchie and the western portions of Monongahela, Marion, Harrison, Lewis and Gilmer counties.

The sudden cutting off of this group by the Ellenboro fault and the consequent wearing away of the rocks by erosion prevent us from obtaining as full a section along this line as may be found farther north. The succession as observed is as follows:

	Ft.	
1. Sandstone and shales	400	
2. Black shale	2	
3. *Coal* "Brownsville"	3	
4. Shale	20	Interval, 38 ft. to 28 ft.
5. Sandstone	5–15	
6. Shale	3	
7. *Coal*	0 2 In.	
8. Shale	20	Interval 75 ft
9. Sandstone and some shale	55	

The total thickness of the group as here exposed is only 520 feet. For comparison, I present a condensed form of the excellent section worked out by Mr. I. C. White (Annals Lyceum of Nat. Hist. Vol. XI, p. 46.), in southwestern Pennsylvania and northwestern West Virginia.

	Ft.	In.	
1. Sandstone and shale	300		491½ ft.
2. Limestone	1	6	
3. Sandstone	190		
4. *Coal*	1	6	
5. Sandstone	95		Interval, 95 ft.
6. *Coal*	2		
7. Shale and Sandstone	85		Interval, 128 ft.
8. Limestone	3		
9. Shale	40		
10. *Coal*	1	4	
11. Shale	10		Interval, 52 ft.
12. Limestone	2		
13. Shale	40		
14. *Coal* "Brownsville"	2–3	6	
15. Shale	20		Interval, 20 ft.
16. *Coal*	1		
17. Shale	15		Interval, 60–65 ft.
18. Sandstone	45–50		

In this section the total thickness ia 860 feet. It will be seen, however, that in my section the strata reach far enough up to include a portion of No. 3, in Mr. White's section, so that sufficient is found in the south to afford material for comparison of conditions in the two areas. It is noteworthy that the interval between the *Waynesburg* and the *Brownsville* is much greater in the southern than in the northern section.

No. 1 of the section is entirely free from limestone, and consists of compact sandstones and loose shales. At the east, the sandstones greatly preponderate, and are very coarse in grain. Westward they diminish in quantity and are replaced by the shales. These are reddish gray to yellow and usually quite fissile. The whole series is finely exposed along the Northwestern pike, about 4 miles west from Salem, where the road descends a long steep hill and is merely a shelf, cut out of these rocks. Near Cherry Camp, thirteen miles west from Clarksburg, the base of the series is a bright yellow fissile shale, 20 feet thick, containing many crushed specimens of an *aviculopecten*. This shale is not persistent, being wanting at all exposures examined farther to the west. The other strata seem to be entirely free from fossils.

Along the Northwestern Railroad, the *Brownsville* (so named by Mr. White, from its importance, near Brownsville, Monongalia county, West Virginia,) coal is first seen at the east end of Brandy Gap tunnel, 10 miles west from Clarksburg. There it was worked formerly, but the banks have long been deserted and no measurement can be made. At the west end of the tunnel the coal is seen about 20 feet above the track and nearly 3 feet thick. Near Cherry Camp, 1 mile beyond, it has been worked in the creek bank by stripping. It shows there:—Shale, 2 ft.; *Coal*, 9 in.; Bony Coal, 5 in.; *Coal*, 14–16 in.; total, 2 ft. 6 in.

The shale is full of vegetable impressions, some of which are very fine. If this shale could be reached farther in the bank, where it has not been exposed to the action of the weather, the locality would no doubt yield some excellent material to the palæobotanist. The coal is said to be of very fair quality. Some taken from the same bed where it lies exposed in the stream, about one-fourth of a mile farther west, is said to have been very good.

The next exposure was found on the Northwestern pike, somewhat more than 5 miles west from Salem. The bed is there more complex than at Cherry Camp, and shows the following section: *Coal*, 9 in.; Shale, 2 ft.; Bituminous shale, 1 ft.; Clay, 3 in.; *Coal*, 1 ft. to 1 ft. 6 in.

The sandstone rests directly on the coal. The bituminous shale contains many thin plates of coal and is so carbonaceous throughout that it will burn, though poorly. The coal is said to be quite good, and is mined by stripping. Near the railroad crossing 2 miles east from Smithton, this bed was formerly worked. At Smithton its outcrop is seen 115 feet above the *Waynesburg*, and near West Union it was observed in a railroad cutting, where it appears to be about 1 foot thick and single.

Near Pennsboro an old opening is seen 20 feet below the level of the railroad. We there find the following section:—Sandstone;—Shale, 10 ft.; *Coal*, 1 ft. 10 in.; Compact clay, 3–6 in.; *Coal*, 8 in.

The overlying shale is argillaceous below, but becomes arenaceous above and passes gradually into sandstone. The rocks are well exposed in the vicinity for nearly 250 feet above the bed and are wholly sandstone and arenaceous shale. The coal seems to be quite good and must contain very little pyrites. The bank has been deserted for nearly 20 years, yet fragments lying on the dump are as sound and fresh-looking as though they had been thrown out within two or three days. The same bed is mined somewhat on the other side of the railroad. The coal is compact, open-burning, and leaves a pulverulent ash, quite bulky but not heavy. The bed can be traced in the vicinity of the railroad almost to Ellenboro. The blossom is seen near the junction of the Northwestern pike and the Harrisville road. Near Harrisville its place is shown by a line of springs. On the Staunton pike it was seen near Smithville, in Ritchie county, where it is one foot thick.

The small coal, No. 7, was observed only in the deep cut at the east end of Brandy Gap tunnel.

The shale underlying the *Brownsville* coal is variable in character and thickness. Occasionally the whole mass of 35 feet is argillaceous, blue, gray or drab, and quite thinly laminated. At other times, the whole interval between the *Brownsville* and the *Waynesburg* is occupied by a coarse sandstone.

The Waynesburg sandstone, No. 9, is a well marked and very persistent member of the series. It is ordinarily a compact and fine-grained sandstone, and at no place along the railroad is it at all conglomerate. Near Brandy Gap tunnel, where it has been largely quarried by the railroad company, its lower portion is somewhat flaggy. At Long Run, Smithton and West Union, it stands out in cliffs upon the hill sides, and is compact throughout. On the Staunton pike, it may be seen just west from Troy, where it is somewhat coaser than at the localities just mentioned.

Upper Coal Group.—Under this name are included all that series of rocks beginning with the *Pittsburg* and ending with the *Waynesburg* coal. Along the Northwestern Railroad the group is well exposed from Clarksburg west. The general section is approximately as follows:

	Ft.	In.	
1. *Waynesburg Coal*	4		Interval, 132 ft.
2. Shale	8		
3. Limestone and shale	6		
4. Argillaceous shale	20		
5. Limestone	1	6	
6. Arenaceous shale	30		
7. Limestone and shale	7		
8. Variegated shale	8		
9. Dark shale	6		
10. Sandstone	40		
11. Shale	6		
12. *Sewickly Coal*	2–3		
13. Shale	41		Interval, 41 ft
14. *Redstone Coal*	3–2		
15. Fire-clay	2		Interval, 20 ft.
16. Limestone and shale	8		
17. Shale	10		
18. *Pittsburg Coal*	6–9		

The interval between the *Waynesburg* and the *Sewickly* is very much smaller than in the northern portion of the State, where it varies from 175 to 200 feet, averaging about 180 feet. Near Morgantown, this interval is 180, at Fairmont almost the same, (the Sewickly has not been seen at Fairmont, and this calculation is based on the relation of the Waynesburg to the Redstone,) at Clarksburg 160, and 10 miles west from Clarksburg, as given in the section above. The interval seems to decrease in this direction. Were this evidence absent, the character of the bed itself would leave no room for doubt respecting its identity with the Waynesburg.

No satisfactory exposures of this coal were observed except near the railroad. Its blossom is seen on the north side of the railroad near Clarksburg, at 160 feet above the *Sewickly*. It is worked slightly at about 9 miles west from Clarksburg, where it shows 4 feet of coal, divided nearly midway by a clay parting one foot thick. From this point westward, it was not seen until within 2 or 3 miles of Smithton, where there have been numerous openings, nearly all of them now deserted. At all of these, the bed is overlaid by 12 feet of dark argillaceous shale, containing vegetable impressions and holding midway, a layer of calcareous iron ore. At Smithton, the coal is worked by Mr. Smith, at whose bank the following structure is shown:—Shale, with vegetable impressions, 4 ft.; *Coal*, 2 ft. 2 in.; Clay, 3 in.; *Coal*, 2 in., Cannel, 3 in.; Shale, dark-gray, fissile, 8 ft.; *Coal*, 1 ft. 6 in.

The coal is not very good, owing to the considerable proportion of sulphur. The bottom layer yields the best fuel, but as it is mined by stripping in the run, the superiority may be owing entirely to the removal of the pyrites by the water. The same bed is mined somewhat extensively at the West Union, where one finds:—Shale, 2 to 8 ft.; *Coal*, Cannel, 3 in.; Clay, 2 in.; *Coal*, 31 in.; Clay, 4–11 in.; *Coal*, 6 in.; Fire-clay, 3 ft.; Shale, to road, 7 ft.

The overlying shale is drab or slate-colored, quite fissile, and contains much nodular iron ore. It exhibits vast numbers of vegetable impressions, chiefly *Neuropteris*, *Cyclopteris*, *Pecopteris* and *Sphenophyllum*. Many of these are beautifully defined and equal those from the same horizon in Monongalia county. This shale varies in thickness at the expense of the sandstone above it. The fire-clay underlying the coal passes gradually into ferruginous, slightly arenaceous shales, below which, some lime limestone is seen further up the stream. The upper parting in the bed occasionally shows leaf prints. The lower parting is variable in thickness, and sometimes holds two sheets of coal, each one inch thick. The main coal is very hard, evidently open-burning and bears much resemblance to semi-cannel. It is said to be an excellent fuel. Though

[CONTINUED ON PAGE 74.]

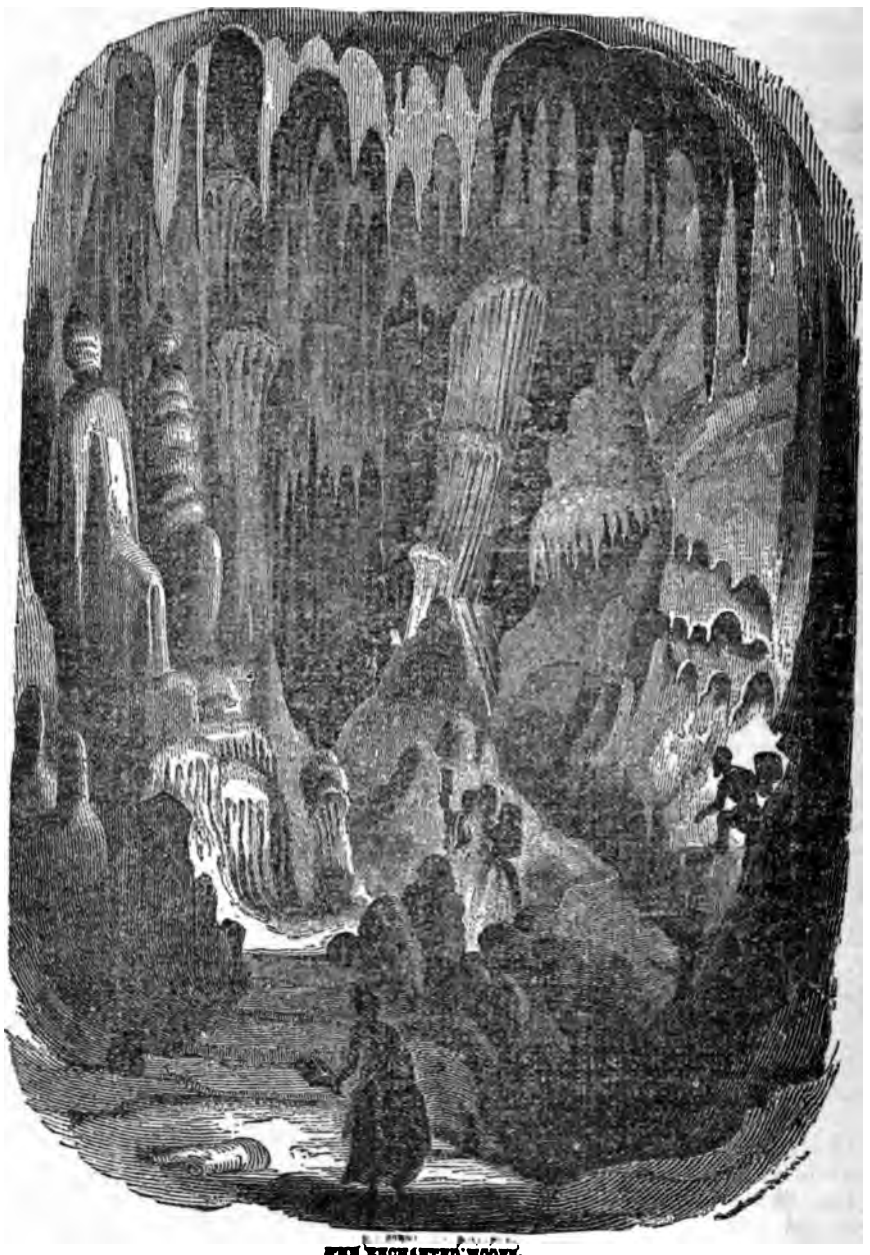
[CONTINUED FROM PAGE 69.]

Port Republic is in the fork of the junction of the North and South rivers, that form the South fork or main Shenandoah. A few miles above this village Middle river enters North river; it is customary to say that Middle and South rivers form the Shenandoah. Five miles to the northward the *Battle of Cross Keys*, between Fremont and "Stonewall" Jackson, June 8th, 1862, was fought. The *Battle of Port Republic*, between Jackson and Shields' advance under Tyler, was fought on the plain at Lewiston, 3 miles below Port Republic; the line of railway crosses the middle of the battle-field at right angles to the positions held by the lines of battle.

Below Port Republic the Potsdam rocks and the wastage from them occupy most of the country from the Blue Ridge to the Shenandoah; the sands of the old river bed making a wide terrace for some miles until the foot hills crowd closely on the river. Soon the Massanutton chain appears on the left and the route is down the eastern valley, that commonly called the "Page valley" from the county that occupies its central portion.

Elkton (Elk-run it should be) is in the valley of Elk run, near a place long known as Conrad's Store, opposite a noted pass in the Blue Ridge, Swift Run gap, the one by which Gov. Spotswood and his followers, the first white men, so far as known, that entered the Valley, crossed the Blue Ridge in 1716 —It was here that Jackson encamped for some time in the spring of 1862, after his retreat up the Valley followed by Banks; and from here he marched to the battle of McDowell in May of that year.

Shenandoah Iron Works, the home of Hon. Wm. Milnes, jr., is the next station; but those wishing to inspect the noted Fox Mountain ore bank, one of the many on the great iron estate, 49 square miles, owned by the "Shenandoah Iron, Lumber, Mining and Manufacturing Co., of Va.," which embraces miles of the length of the Massanutton and of the Blue Ridge and of the intermediate valley,—will be conveyed, in iron-works wagons, fitted up by Mr. Milnes for the occasion, from Waverlie, at the Naked creek crossing, some 4 miles to these remarkable beds of Primordial iron ore near Furnace No. 2. The sections across this valley and its bounding mountains, published in THE VIRGINIAS for June, 1880, show the geological structure of this region and the place of its great beds of iron ore, the Primordial ones along the barren-like foot hills seen on the right, and the Silurian ones, Hudson River (III) and Clinton (V) on the flanks of and within the Massanuttons.—The ores at Fox mountain are unexceptionally good ones, and the best of neutral iron is made from them. By Booth & Garrett's analysis they contain 55.84 metallic iron, 12.85 water, 0.06 phosphorus, 0.80 alumina, 0.05 magnesia, and 6.75 silica. *Furnace No. 2*, a 9x36 stack, was built in 1857, and from that time has been almost continually in operation, producing hot-blast charcoal pig. Mr. Milnes claims, as the result of a dozen years' experience, that he can make charcoal pig here for $16.00 per ton, and coke pig iron for $10.75.



THE ENCHANTED MODEL.
WEYER'S CAVE

At Shenandoah Iron Works there were formerly in operation a furnace and forge, near the river; the former has been abandoned for a number of years, Furnace No. 2, near the ore beds, taking its place; the latter was destroyed by the great freshet of 1870. The bloomary now in operation there, was built in 1871; Swank (1880) describes it as having "7 forge-fires, one 6-tueyre run-out, and 1 hammer; product, charcoal blooms for boiler plate and flange iron, made from pig iron, annual capacity 1,800 net tons." We may add that a large proportion of its product is used for wire. The company owning this magnificent estate has recently been reorganized, and improvements commensurate with its resources and facilities for the cheap manufacture of superior iron will soon be made.

The kilns of the *Rockdale Lime Co.* are passed a short distance below Shenandoah Iron Works. This is a new enterpise developed by the opening of the railway, one that in the hands of R. Lee France, of Pa., and Messrs. Coffman and Milnes, of Va., must prove a success. The Co. publishes the *Rockdale Enterprise*, a sprightly monthly, diffusing much valuable information.

Catherine furnace, belonging to the Shenandoah &c. Co., not in operation now, is inside the S. W. Massanutton ranges, in the gap seen to the westward from East Liberty. The beds of Clinton ore are there very extensive.

The *Oxford Ochre Co.*, a Michigan corporation, C. S. Foote, of Detroit, president, has its mines and mill near the railway at Stony Creek crossing. It began operations there in 1876, and has sent over 4,000 tons of an ochre that ranks with the best, to marke The ochre mined there is in beds in the Primordial or Potsdam shales

Near Marksville are extensive deposits of limonite iron ore that Capt. John Donovan and associates are now opening; and higher up the Blue Ridge, towards Milam's gap, are beds of magnetic and specular ores.

Luray and its wonderful *Cavern* we have not room to describe now; these will be seen by the Institute, and, we doubt not, duly appreciated.

The Richmond and Alleghany RR. Excursion of Saturday, June 4th, will embrace the following stations.

Richmond & Alleghany RR. Stations. (Alleghany Division.)	County in Va.	Miles from Williamson.	Feet above Tide.†
Williamson*	Alleghany.	....	1,053
Iron Gate	"	2	1,026
Lick Run	Botetourt.	4¼	1,014
Wilton	"	7	....
Baldwin	"	9½	....
Hadon's	"	11	....
Price's Bluff	"	12½	....
Gala Water	"	13¾	....
Eagle Rock*	"	17¾	932
Salisbury	"	22	888
Saltpetre Cave	"	25	....
Millville	"	27½	....
Jackson	"	30¾	841
Buchanan*	"	35	812
Indian Rock	"	41½	786
Gilmore	Rockbridge.	49	742
Glenwood	"	52½	....
North River	"	55	706

*Telegraph stations. †These altitudes (except the Williamson) are those of the James R. & Kanawha Canal; those of the railway will probably be a few feet higher.

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AT 8 1/2 O'CLOCK.
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The Chesapeake & Ohio Railway Excursion of Thursday and Friday, June 2d. and 3rd, will embrace the following stations:

Chesapeake & Ohio Railway Stations.	County and State.	Miles from Richmond.	Miles from Huntington.	Feet above Tide.
Staunton*	Augusta, Virginia.	136.38	284.65	1,387.
Lagrange	" "	139.50	281.53	.....
Swoope*	" "	144.31	276.72	1,653.
Buffalo Gap*	" "	147.26	273.77	1,885.
N. Mountain	" "	149.50	271.53	2,060.
Ferrol*	" "	153.33	267.70	1,812.
Pond Gap	" "	155.15	265.68	1,677.
Craigsville*	" "	159.35	268.68	1,516.
Bell Valley	Rockbridge, "	164.44	256.59	1,507.50
Una	" "	167.00	254.03	.....
Goshen*	" "	168.44	252.59	1,410.
Panther Gap	Bath, "	171.50	249.53	1,590.
Millboro*	" "	175.51	245.52	1,679.50
Mason Tunnel	" "	177.39	243.64	1,550.
Crane*	" "	181.50	239.53	1,361.
Griffith	" "	186.00	235.03	1,165.
Longdale*	Alleghany, "	189.70	231.33	1,150.
Williamson*	" "	192.62	228.41	1,053.
Jackson River	" "	195.07	225.96	1,135.
Low Moor	" "	196.75	224.28	1,155.
Steele	" "	200.07	220.96	1,210.
Covington*	" "	205.41	215.62	1,245.
Callaghan*	" "	210.86	210.17	1,427.
Backbone*	" "	215.36	205.67	1,690.
Alleghany*	" "	221.70	199.33	2,050.
Tuckahoe	Greenbrier, West Va.	223.42	197.61	.....
White Sulphur*	" "	227.15	194.88	1,917.
Caldwell*	" "	232.60	188.43	1,765.
Ronceverte*	" "	237.90	183.13	1,650.
Fort Spring*	" "	244.32	176.71	1,625.
Alderson*	Monroe, "	251.14	169.89	1,550.
Mohler's Mill	" "	253.24	167.79	1,527.
Lowell	Summers, "	260.75	160.28	1,510.
Talcott*	" "	262.50	158.53	1,510.
Greenbrier	" "	268.00	153.03	1,434.
Hinton*	" "	272.69	148.34	1,368.
Fox	" "	276.61	144.42	.....
New Richmond*	" "	281.58	139.45	1,290.
Meadow Creek	" "	285.00	136.03	1,265.
Pawpaw	" "	289.60	131.43	1,237.
Quinnimont*	Fayette, "	294.26	126.77	1,195.
McKendree	" "	297.69	123.34	1,150.
Stone Cliff	" "	304.50	116.53	.....
River View	" "	305.70	115.33	.....
Dimmock	" "	307.46	113.57	1,045.
Fire Creek*	" "	309.70	111.33	.....
Sewell*	" "	312.81	108.22	1,004.
Caperton	" "	314.75	106.28	.....
Nutallburg	" "	316.86	104.17	948.
Fayette	" "	319.25	101.78	908.
Hawks Nest*	" "	324.09	96.94	828.
Cotton Hill*	" "	326.20	94.83	896.
Kanawha Falls*	" "	333.31	87.72	672.
Loup Creek	" "	337.18	83.85	647.
Frederick	" "	341.09	79.94	....
Cannelton*	Kanawha, "	342.69	78.34	636.
Paint Creek*	" "	348.15	72.88	622.
Blacksburg	" "	350.37	70.66	626.
Coalburg*	" "	352.76	68.27	625.

The Great Kanawha Improvement.

OFFICE OF ROBINSON COAL CO.,
COALBURG, W. VA., April 26th, 1881.

JED. HOTCHKISS, ESQ.,

Dear Sir—The liberal appropriations by the U. S. Government to the improvement of the Great Kanawha river have apparently called considerable attention to it, and I have had, within the last few months, a great many enquiries as to the profitableness of opening coal seams on the north side of the river and using the river exclusively as an outlet to market. These enquiries have led me to collect such statistics as were available. They are not carried down to as recent a date as I should like, but they are sufficient to show the regularity with which shipments can be made by miners on the opposite side of the river from the railway and depending on the river for transportation.

Thinking that some of these figures might be of interest to your readers, I append them, in tables, to this. The records were made by the U. S. Engineers at Charleston, but the completion of Locks Nos. 4 and 5 gives to all the mines between Brownstown and Paint Creek the same facilities for shipping that they would have if located at Charleston.

From records kept in this office while loading barges in Kanawha river, we get the following as the average carrying capacity of ordinary boats and barges, when loaded to different depths:

Loaded to even	4 ft	they will	carry	7,862	bush.
" " "	4 6 in.	" "	"	8,771	"
" " "	5 ft.	" "	"	9,705	"
" " "	6 ft.	" "	"	11,586	"

The full capacity of boats and barges of standard size—130′ x 24′ x 7½′, is a trifle over 12,000 bush.

Yours truly,

NEIL ROBINSON.

1. Table showing No. of days each year that river stood above given gauge.

Period.	4′	5′	6′	7′	8′	9′	10′	11′	12′	13′	14′	15′	16′	17′	18′	19′	20′
Aug., 1872, to Aug., 1873,	249	194	159	135	107	85	66	61	52	41	35	31	25	19	15	12	10
Aug., 1873, to Aug., 1874,	238	172	123	81	60	46	29	23	20	16	14	11	10	9	8	6	5
Aug., 1874, to Aug., 1875,	275	226	178	135	91	61	43	31	26	20	18	16	15	12	9	9	8
Aug., 1875, to Aug., 1876,	265	237	171	119	68	38	23	15	10	6	3	1	..	..	..	..	..
Aug., 1876, to Aug., 1977,	264	185	142	96	54	42	35	24	20	18	15	14	13	12	12	10	6
Total,	1311	1014	774	566	380	272	196	154	128	101	85	73	63	52	44	37	29
Average,	262.2	202.8	154.8	113.2	76.	54.4	39.2	30.8	25.6	20.2	17.	14.6	12.6	10.4	8.8	7.4	5.8

In the first line of the above is the feet of depth of the river, from 4 to 20, above the guage; in the following lines are given the number of days, in the Aug. to Aug. years named, that the river was above the gauge to depth given in first line.

2 Table of averages 5-ft. stage.

Month.	No. of years.	Total No. tides.	Total days duration.	Average tides per month.	Average days duration pr. month.	Time.
January	7 years.	10	166	1 3-7	23 5-7	1873-79
February	7 "	8	171	1 1-7	24 3-7	1873-79
March	7 "	8	212	1 1-7	30 2-7	1873-79
April	7 "	7	210	1	30	1873-79
May	7 "	7	173	1	24 5-7	1873-79
June	6 "	11	87	1 4-7	12 3-7	1873-78
July	6 "	8	63	1 2-6	10 3-6	1873-78
August	6 "	8	75	1 2-6	12 3-6	1873-78
September	6 "	4	38	4-6	6 2-6	1873-78
October	6 "	5	27	5-6	4 3-6	1873-78
November	6 "	8	107	1 2-6	17 5-6	1873-78
December	6 "	8	128	1 2-6	21 2-6	1873-78

3. Table of Boat Tides Exceeding 5 ft.

MONTH.	1873	1874	1875	1876	1877	1878	1879
January	1-31	1-12 1-9	1-11 1-6	1-10 1-13	1-23	1-29	1-22
February	2-28	1-28	1-8 1-10	1-29	1-12	1-28	1-28
March	1-31	1-14 1-12	1-31	1-31	1-31	1-31	1-31
April	1-30	1-30	1-30	1-30	1-30	1-30	1-30
May	1-31	1-12	1-24	1-31	1-31	1-31	1-13
June	1-12	.....	1-24	1-4 1-6	1-2 1-6 1-6	1-4 1-6 1-10	1-7
July	1-4	1-5	1-31	1-10 1-11	1-4 1-4	1-4 1-12	
August	1-2	1-3 1-4	1-29	1-12	.....	1-3 1-10	
September	.....	.....	1-2	1-19	.....	1-7 1-10	
October	1-6	1-6	1-1		1-4	1-10	
November	1-3 1-4 1-4	1-8	1-26	1-10	1-22	1-30	
December	1-25	1-11 1-14	1-16 1-7	1-5	1-19	1-31	
Totals	13-211ds	14-168	15-211	14-256	13-194	17-286	

EXPLANATION.—The figures on the left indicate the number of times in the month that the river reached 5 ft. The figures on the right show the number of days it remained at 5 ft. and upwards.

Sale of Kanawha Coal Lands.—We are gratified to learn that Mr. A. A. Low, of New York city, one of its large capitalists and most enterprising merchants, a gentleman who owns large interests in the Low Moor Iron Co. of Va., has recently purchased 3,000 acres of coal land on Slaughter creek, a stream some 6 miles long that empties into the Great Kanawha 1.5 miles below Coalburg, on the C. & O. Ry.—The land purchased extends southward from the Great Kanawha river for nearly 6 miles, and from the Cabin creek and Slaughter creek divide westward to Slaughter creek, varying in breadth from ¼ of a mile to 1½ miles. The lands are in the central portion of the Great Kanawha coal field, where there are a half dozen or more thick beds of excellent coal above the water level, and so disposed that they can be worked to the greatest advantage. The valley of Slaughter creek is one of the very best in the whole region for the cheap construction of a railway; the coal beds on the land purchased all slope towards this valley. The C. & O. Ry. and the Great Kanawha are both available for transportation. Mr. Low never made a more judicious purchase of coal lands, though he has purchased largely on New river and elsewhere.

[Continued from Page 71.]

showing but little pyrites, when freshly mined, it becomes streaked with copperas when exposed to the weather. In this vicinity the bed is cut by numerous vertical seams of drab clay, which are quite distinct in the solid coal.

Along the Staunton pike this bed is much degraded. Several openings have been made upon it between Smithville and Troy, but it nowhere exceeds 2 feet. At a short distance east from Harrisville, in Ritchie county, it is found varying from 6 to 18 inches in thickness.

Northward from the railroad this coal steadily increases in thickness until near the State line it averages more than 8 feet, varying from 8 to 11. It is rarely single, usually double, and frequently triple.

The rocks occupying the interval between the *Waynesburg* and the *Sewickly*, show variations which deserve some consideration. Near the State line on the Monongahela river we find here 56 feet of limestone, and at Wheeling there is one mass of limestone and calcareous shale, fully 100 feet thick. At both localities much of the limestone is compact and quite pure. Along the northwestern pike and the railroad, not more than 16 or 20 feet of limestone can be found, and most of this is so poor that it ought rather to be called a compact calcareous shale. Still farther south, along the Staunton and Parkersburg pike, not one foot of limestone was observed in this interval. From the northern portion of the State to the railroad, the limestone diminishes and gives place to shale, but from that line southward the shale apparently disappears, and sandstones appear instead. Along the railroad the limestones were seen near Wolfe summit, near Smithton and West Union. Traces of them occur east from Harrisville.

The *Sewickly coal* was indentified at only two localities. At Clarksburg, it occurs 2 feet 6 inches thick, and 70 feet above the Pittsburg. No attempt has been made to ascertain its value. On Wolfe Summit, eight miles west from Clarksburg, the coal is only 2 inches thick. This bed seems to have as little persistence as the coals of the Barren Group, when traced southwardly. It has not been found at Fairmont, in Marion county. (In my previous paper, I stated that it occurred at Fairmont. I had misunderstood the statement made to me by Ex-Governor Pierpont, respecting the coals of that vicinity.) No traces of it occur along the Staunton pike, in Gilmer county, and I cannot speak with certainty respecting its presence in either Lewis or Upshur county. It is, however, by no means improbable that the small coal above the Pittsburg in the latter county, is the Sewickly, and not the Redstone.

The interval between the *Sewickly* and the *Redstone* is entirely free from limestone. . It is occupied by shale, none of which is calcareous. At Wheeling this space is filled with limestone, and on the Monongahela river near the state line, it contains 31 feet of limestone. On the Staunton pike the shales are replaced by flaggy sandstones.

The *Redstone* is a wide-spread and persistent coal, though rarely of economical value in West Virginia. At Fairmont, in Marion county, it is 3 feet thick and of good quality, but is not mined. Between that town and Clarksburg, its blossom is frequently seen in the roadside, and at the latter place it is 6 inches thick at the outcrop. At Wilsonburg, 4 miles west from Clarksburg, it is barely one foot thick, while at Coketon, two miles beyond, it is 4 feet, and of excellent quality. Where last seen toward the west, at Wolfe Summit, it is only 3 inches thick. A thin coal, varying from 1 to 2 feet, is found above the *Pittsburg* in Upshur county. Whether or not this is the Redstone, the material in my possession is not sufficient to decide.

The rocks occupying the interval between the *Redstone* and the *Pittsburg* are subject to great variations in character and thickness. At Fairmont the interval is 80 feet, at Pruntytown, 75, at Bridgeport, 65, and at Weston, somewhat less. At all of these localities which lie along a nearly northeast and southwest line, the interval is occupied by sandstone and shale at the base, and limestone on top. Westward from such a line passing through Morgantown, Fairmont, Bridgeport and Weston, the distance between the coals rapidly diminishes. At Clarksburg, it is 25 feet, occupied by shale or sandstone; at Wilsonburg, it is the same, filled with argillaceous shale; at Coketon, it is 28 feet; while at Wolfe Summit, it is 20 feet, the rocks being shale and limestone. A similar condition exists in the vicinity of Morgantown, as stated in my previous paper.

The limestone disappears altogether before reaching the Staunton pike, so that with the exception of a few scattered nodules no limestone occurs among the strata of this group along that line.

Pittsburg Coal —The eastern limit of this bed aside from small outlying areas, is marked by a line beginning near Cheat river, on the Pennsylvania border, and extending west of south to Fairmont, and crossing the Tygart Valley river, a little above that town. Thence irregularly to Pruntytown, where it turns east by south to Flemington. From this point it follows a south-southeast course, almost to Tygart river, thence southward, crossing the Buckhannon river near the Upshur county line. There it again turns east by south, and so continues almost to the Middle fork of that river, when the course changes to southwest, and so remains to the line between Upshur and Lewis counties. From this locality to where the bed crosses Pocatalico creek near the Great Kanawha river, I have not followed it. The extreme eastern exposure occurs in Upshur county, about 5 miles from Buckhannon, on the Staunton pike.

The extreme western line of exposure begins at the Pennsylvania line, nearly 2 miles west from Monongahela river, crosses that river about a mile below Fairmont. It lies a little west from the West Fork river, crossing Harrison county from Shinnston to Wolfe Summit, on the Northwestern Railroad. Thence it runs southwestward through Lewis county, reaching Gilmer, near Troy, on the Staunton pike, and crossing the Little Kanawha, just below Glenville.

Owing to the abruptness of the Laurel Hill anticlinal, the area in which this bed is available is very narrow at the north, hardly more than six or seven miles wide. Southward the anticlinal becomes gentler and this area rapidly increases in width until along the Staunton pike the coal is available for a distance of nearly 40 miles. The bed attains its greatest thickness toward the north, and diminishes toward the south and southeast.

In Monongalia county, this bed is double, except where overlaid by sandstone. This characteristic prevails in Pennsylvania and Ohio, as well as in the Ohio "Panhandle" of West Virginia. But southward from Fairmont this division is rarely marked by a distinct clay parting, though the difference between the upper and lower benches sufficiently proves that the bed is still double. Occasionally, however, as at Shinnston and near the tunnel east from Clarksburg a well-defined clay parting separates the two benches.

In Upshur county the openings are quite numerous in the vicinity of Buckhannon, and the *Pittsburg* is the only source of supply for a large area. The coal varies from 3 feet 9 inches to 4 feet, and is said to be of very fair quality. Though the parting is exceedingly thin, the upper and the lower benches are very distinct, the former being hard and leaving a bulky red ash, the latter being soft and clean, yielding a white ash. In the northern part of the county, very near the Barbour county line, the coal is mined on the Westfall property, where it shows:—*Coal*, 32 in.; Parting, ⅛ in.; *Coal*, 34 in.; total, 5 ft. 6 in.

Though very thin, the parting is persistent. The upper bench is quite hard and contains a good deal of bony semi-cannel, but the proportion of good clean coal is quite large. It burns well, but leaves a bulky ash. The lower bench is a remarkably clean coal. Layers of apparently pure bitumen are seen, 2 to 4 inches thick, structureless, showing no lamination, and breaking with beautifully conchoidal fracture. At this opening the coal is exceedingly good, and shows no pyrites under a glass. It does not disintegrate upon exposure, nor does it exhibit streaks of copperas. Near this opening is the Connolly bank. At the time when it was examined, this had not been fully opened, and only 5 feet of coal were exposed. The appearance is somewhat strange, as no division into benches can be made out, and the bed seems to be homogeneous. The coal is pure throughout, and evidently very rich in volatile combustible matter. The coal from these banks would yield an excellent coke, and would be exceedingly profitable in gas-making.

In Lewis county, this bed is easily accessible, and it is worked quite extensively to supply local demand. Openings were examined only along the Staunton road, though many were seen on the West Fork river, both above and below Weston. In the central portion of the county the thickness varies from 4 feet 6 inches to nearly 8 feet, increasing northward. The bed is apparently single, but close examination shows the existence of two benches, the upper being invariably harder and less pure than the lower. Owing to the thinness of this bed in the southern portion of the county, many persons do not believe it to be the *Pittsburg*, but refer to that horizon the *Upper Freeport*, which appears to be quite thick in the river near Weston.

In Gilmer county the coal is mined near Glenville, where it is from 4 to 5 feet thick. About one mile east from Troy, an opening shows the following section:—Shale, gray, 8 ft.; *Coal*, 29 in.; Parting, ½ in.; *Coal*, 38 in.; total, 5 ft. 7½ in.

The coal is very good and shows but little pyrites. The upper bench is quite compact and leaves a red ash. The lower is softer and burns more readily, leaving a not bulky, white ash. About one-half mile farther east is a bank in which the coal is 7 feet at the mouth, and farther in is said to reach 9 feet. Near the county line the coal is again opened, but there it is barely 5 feet thick.

In Harrison county, openings are quite numerous along the railroad, and the coal is mined extensively for shipment. Notwithstanding the presence of a good deal of pyrites, it finds a ready market as a gas coal.

At Clarksburg, one of the most extensive openings shows the structure of the bed as follows:—*Coal*, 3 ft. 6 in.; Parting, ⅛ in.; *Coal*, 5 ft. 4 in.; total, 8 ft. 10 in.

Excepting 4 inches at the bottom, the lower bench is a fine clean coal, while the upper bench is somewhat bony, quite hard and bears much resemblance to the ordinary roof coal of this bed as seen farther northwest. The parting varies from ⅛ in. to 1½ in. and is persistent in all the openings in this vicinity. In the lower bench there occur three thin partings, 12, 15 and 18 inches respectively from the bottom, between which is the soft coal, the "bearing in bench" of the miner. The character of this lower bench is precisely the same with that of the lower division of the Pittsburg throughout northern Ohio. Some pyrites occur here, but the quantity is not great. The upper bench contains a layer of "slate," 4 inches thick and irregular in its place. On the north side of the railroad the seam is much troubled by sandstone horse backs, some of which are quite extensive, having been traced for more than half a mile across the entries of different openings. In one bank such a horseback was found, 8 feet wide. It was followed for 500 yards, but showed no sign of thinning out. Along the whole distance, it has not only cut out the coal, but has also trenched the fire-clay and sandstone below. It is said to be more compact than the overlying sandstone.

At Wilsonburg, 4 miles west from Clarksburg, the coal shows an average thickness of 7 feet 6 inches. but near the mouth of the main entry increases to 8 feet 4 inches. The parting is black clay, and varies from ⅛ to 2 in. The coal at the base for one foot is very poor and hardly marketable, but the remainder of the lower bench is a very fine coal, containing, it is true, much nodular pyrites; but this is easily separated. There are no well defined minor partings in this bench. The upper bench is quite hard and contains much splint coal. It is said to be quite as good for gas-making as the lower portion is, so that all parts of the bed are shipped together, the single foot at the base excepted, as that is too sulphurous.

At Coketon, the bed varies from 5 to 7 feet. For 3 inches at the bottom the coal is very bad, but the whole bed above is taken out for shipment. The upper bench is heavy, compact and leaves much ash. The parting is one inch thick and consists of hard carbonaceous clay. Pyrites occur plentifully throughout the bed, but, being in nodules, is readily removed. The roof is a slick-ensided clay.

Where the bed disappears, near Wolfe Summit, it is 6 feet thick and roofed with 10 feet of argillaceous shale. East from Clarksburg, it is mined at Bridgeport and several other localities, but only to supply local demand. Numerous banks are worked in a small way along the West Fork river, and on the road to Shinnston, in this county. They show no material difference from those already described.

In Taylor county, openings were seen near Pruntytown and Flemington, in each case near the eastern outcrop of the coal. At Pruntytown, the bed is single and nearly 8 feet thick. Above it is a dull reddish-gray shale, on which rests a massive sandstone. The coal, for the most part is somewhat inferior here, as the roof is very thin and usually not sound. At Flemington the thickness is 8 feet. There are no distinct partings, and the roof is a shaly sandstone, which occasionally forms a troublesome horseback. The coal from the banks here is said to be very good and to command a ready market for use in gas-masking.

(To be Continued.)

Irondale Furnace, Raccoon, Preston Co., W. Va., Alex. Strausz, general manager, is now making 800 tons of foundry and mill coke pig iron a week. It is now getting some ore from Madison Run, Orange Co., Va., to mix with the native carbonates now used, for the purpose of making a strong neutral iron. It will also use some primordial ore from Shenandoah Iron Works, Page Co., Va., as soon as the branch road is completed from the S. V. RR. to its ore beds. An effort will be made for an exchange trade, bringing coke to the Va. furnaces and taking back ore.—Surveys are being made for a railway from this furnace to Morgantown and thence to Pittsburg; it is expected that the work of constructing it will begin by the middle of June.

Belmont Furnace, Wheeling, W. Va.—In our last number we quoted Swank's Iron and Steel Works of U. S., 1880, and the Iron Age in reference to this furnace. A letter from Manager Thos. McCune asks us to say that the size is 55 x 14, and not 63 x 14, and daily product 61 tons, and not 16, as before stated.—We are pleased to make these important corrections, not only for the sake of accuracy of statement, which we use every effort to secure, but also to put the present good work of this W. Va. furnace before the public.

The Virginia Meeting of the Am. Institute M. Engs. is pleasantly announced in the following kindly words by the *Engineering and Mining Journal* of New York,—the best conducted of the mining journals of this country, especially just now when well "starred" by Dr. Raymond's contributions.

"The next meeting of the American Institute of Mining Engineers is to begin, as we understand, at Staunton, Virginia, on Monday evening, May 30th. When we say that James F. Lewis is engineering the local preparations, we call up reminiscences of the famous Amenia meeting, not yet eclipsed by later glories, and certain to inspire assured confidence of a "good time."

"From the April number of THE VIRGINIAS (which is, by the way, a handsome and vigorously conducted journal, published at Staunton by Mr. Jed. Hotchkiss, and devoted to the development of Virginia and West Virginia), we learn that there will be excursions over the Shenandoah Valley RR., the Valley Branch of the Baltimore & Ohio, the Chesapeake & Ohio, and the Richmond & Alleghany roads, including visits to the White Sulphur Springs, the New River Gorge, the Falls of the Kanawha, perhaps the Natural Bridge, and the Balcony Falls of the James. There will certainly be no lack of magnificent scenery; and, on the other hand, the professional purposes of the meeting, apart from the important papers expected or promised, will be served by the view of a goodly number of enterprises in progress, and a vast exhibition of natural resources in iron, coal, salt, etc.

"The geologist will find in these excursions some of the grandest sectional exposures on this side of the continent. And finally, a large number of members will find—what is not the least attraction—one another."

Atlantic & Ohio RR.—Gen. Thomas Ewing, of Ohio, writes us that himself and other gentlemen of prominence in railway affairs are now engaged in the organization of a company of capitalists in New York city, having for its object the construction af a railway from Mathias Point on the Potomac, via Fredericksburg, the line of the Piedmont, Fredericksburg & Potomac to Orange, the route of the Royal Land Co. RR. by Swift Run gap, crossing the Shenandoah Valley RR. at Conrad's Store, to Harrisonburg, Va., thence across W. Va. to the head of Elk river, down that river to Charleston, and thence down the Great Kanawha to its mouth to a connection with western roads now in operation to Gallipolis, Ohio. The road will be an intermediate one in the very large territory, abounding in mineral, forestal, and agricultural resources, lying between the Baltimore & Ohio and the Chesapeake & Ohio, and that is now neither traversed nor penetrated by railways. The route offers many advantages for another line from the west to the deep and commerce favoring waters of the Chesapeake, the great many-armed harbor of the Atlantic. The well known facts of the resources of the country to be traversed by this Atlantic & Ohio RR., as it is to be called, warrants its construction, leaving out of the question the advantages it will have as a through line. Properly located in reference to the leading resources of the country and then economically constructed and operated, this can be made, beyond question, a handsomely paying road. Not only will the railway itself be a good investment, but it will open to investment and settlement one of the most wealth-abounding of the undeveloped portions of the Atlantic slope of the Union.

The Virginia, Kentucky & Ohio RR. Co. has chosen Samuel Leece its president, C. T. Smith vice-president, Chas. F. Palmer treasurer, C. R. Boyd secretary, and G. C. Wharton chief engineer. It is reported that this Co. will construct the S. W. Va. division of the Richmond & Southwestern Ry, 200 miles of which, between Louisville and Pond Gap, Ky., have been let to contract for construction. The U. S. Commercial Co. has made an agreement to construct and equip the entire line and branches of the R. & S-W. Ry, (as mapped in the June, 1880, No. of The Virginias). It asks that $300,000 of its stock shall be taken, payable in county bonds and money, and that 150,000 acres of land shall be given, to be paid for in stock, as conditions precedent to the construction of the S. W. Va. division.—It is reported that a proposition has been made to connect this road with the Richmond & Alleghany RR. at Craig-creek mouth, Botetourt county, Va.

The Mineral "Dufrenite" in Rockbridge Co., Va.

For The Virginias.

As long ago as the summer of 1875, Col. B. J. Jordan, one of our distinguished iron masters, brought to my office for examination a variety of samples of iron ores. One of these had arrested his attention on account of its peculiar structure and color. It had been taken from the mine partly in the form of irregular nodules, and partly as incrustations on masses of limonite ore. When broken open the newly exposed surfaces presented a radiated fibrous structure, with rather a dull silky lustre, and a dark greenish brown (almost black) color. Where the surfaces of the nodules and incrustations had been exposed to the weather the fibres had become changed in color to a yellowish brown, near to that of some specimens of limonite, while the original structure was preserved.

I had not, previous to that time, had the good fortune of seeing any well characterized specimens of "Dufrenite," and was therefore not prepared to class the sample at once, bu proceeded to subject it to crucial tests.

On reducing it to fine powder, the color became a light yellowish green. When heated in a closed tube it gave off water freely, and when moderately coarse fragments were heated to low redness they lost their original color, and became of a reddish chestnut brown. A fragment before the blowpipe fused readily to a black magnetic bead. With the borax bead on platinum wire it gave the reactions of iron.—Small fragments of it, (or still better in fine powder), dissolved freely in hot hydrochloric acid. Tests applied to the solution indicated that the greater part of the iron was in the ferric form (peroxide), while a smaller portion was ferrous, or protoxide. Reactions for phosphoric acid were very decided.

Its structure, color, lustre and specific gravity with these tests applied led me to the conclusion that it was "Dufrenite"—not exactly as I had seen it in poorly characterized specimens, but as described in the books.

A subsequent analysis of a choice sample gave me the following results:—Its specific gravity was 3.382, and hardness 4.

Its chemical constituents in 100 *units.*

Water, lost at red heat,	8.531
Insoluble silica, very fine,	0.115
Ferrous oxide (protoxide)	6.144
Ferric oxide (peroxide)	50.845
Alumina,	0.212
Manganous oxide,	0.403
Lime,	1.124
Magnesia,	0.762
Phosphoric acid (*pentoxide*).	31.761

Some samples more recently tested left but a trace of silica when dissolved in hydrochloric acid.—Other samples have been found far less pure than the one of which the analysis is given.

If a sample in coarse powder be kept at a high red heat in an open crucible for some time after the water has been expelled, it will be found to increase very perceptibly in weight. This I venture to attribute to a higher oxidation of ferrous phosphate, changing it to ferric phosphate and ferric oxide.

Its geological position.—On visiting the locality where the Dufrenite is found, it was ascertained to be about ten miles, by an air line, directly east of Lexington, and about two miles northeast of a large mountain branch running down from the Blue Ridge, and known as Irish creek.

The bed of ore was found near the crest of what is locally called "South mountain"—one of the numerous Primordial ridges that skirt the N. W. base of the main Blue Ridge—thus forming the S. E. border of the Great Valley.

The "Dufrenite" is found in the upper member of the Primordial or Potsdam group—in the ferriferous shales that immediately overlie the Potsdam sandstones, and, at this point, extend to the crest of the ridge. Its position will be readily understood by reference to a section of the Blue Ridge and Great Valley, published in The Virginias of March, 1880, page 42, and cutting the range only a few miles S. W. of Irish creek. Imagine the stratum marked 1 *g* to be extended nearly to the top of 1 *f*, and its upper limit will correspond with the position of the Dufrenite.

A rude shaft or pit has been sunk through the bed of Dufrenite, and penetrates an underlying bed of limonite to a depth of 10 or 12 feet. The bed of Dufrenite, made up of irregular nodules and incrustations resting directly upon the limonite, has an average thickness of about 10 or 12 inches—as far as could be determined after some caving-in of the mine. Col. Jordan in mining had required this mineral, as of doubtful character, to be kept apart from what he knew to be limonite ore; and when he closed his preliminary examinations at that point, two or three tons of mineral were left lying in a pile at the mouth of the shaft.

Notwithstanding the fact that the locality is difficult of access by any kind of conveyance, and not very easily reached even on horseback, the whole mass of the Dufrenite that was thrown out has been taken away, and sent off to various sections of the country—to public institutions, private collectors, and dealers in minerals. But with a little enterprise, and at no very great cost, large quantities could still be obtained—unless the deposit proves to be more limited than the present exposure indicates. This is no doubt the most remarkable deposit of this mineral yet discovered in the United States.

J. L. Campbell.

Washington & Lee University, May, 1881.

Centre of Population of U. S.—Bulletin No. 145 of the 10th-Census, just issued, accompanied by maps, is devoted to statements in reference to the centre of the population of the United States at each census—that is "the centre of gravity of the population of the country," as Census Geographer Henry Gannett, under whose direction the bulletin was prepared, puts it. The movement is to us an especially interesting one, since for five decades, 1810 to 1850, the centre was in the Virginias, along the parallel of N. lat. 39°, a line it still adheres to.

The following table shows the movement of the centre of population:

Date.	Position of centre of population. N. latitude. ° ′	W. longitude. ° ′	Approximate location by important towns.	Westward movement during preceding decade. Miles.
1790	39 16.5	76 11.2	23 ms E. of Baltimore, Md.,	.....
1800	39 16.1	76 56.5	18 ms W. of Baltimore, Md ,	41
1810	39 11.5	77 37.2	40 ms N. W by W. of Washington, near Leesburg, Va.,	36
1820	39 05.7	78 33	16 ms N. of Woodstock, Va.,	50
1830	38 57.9	79 16.9	19 ms W. S. W. of Moorefield, in W. Va.,	39
1840	39 02	80 18	16 ms S. of Clarksburg, in W. Va.,	55
1850	38 59	81 19	23 ms S. E. of Parkersburg, W. Va.,	55
1860	39 00.4	82 48.8	20 ms S. of Chillicothe, in Ohio,	81
1870	39 12	83 35.7	48 ms E. by N. of Cincinnati, in Ohio,	42
1880	39 04.1	84 39.7	8 ms W. by S. of Cincinnati, in Ky.,	58
			Total,	457

Coal Mining in W. Va. in the 10th-Census Year.

We are indebted to Mr. M. L. Haller, of Cumberland, Md., Special Agent of Census, our very energetic and capable assistant in obtaining the mining statistics of W. Va., for the items of production given below.—The questions as to the position of the coal beds in the carboniferous series, raised in previous notes, are answered by the paper of Dr. Stevenson, a part of which appears in this number.

Ritchie County, of which Harrisville is the county-town, is drained by the headwaters of Hughes river of Little Kanawha; it is crossed by Parkersburg branch of B. & O. RR. During the 10th-Census year 14 coal mines were worked in this county, all on a small scale but one, that of David Pugh, at Petroleum, which produced some 75,000 bushels; the product of the county was about 2,850 tons. All the mines were in a 3-ft. bed called semi-bituminous, which Dr. Stevenson appears to place in the Lower Coal group. This county is in the "disturbed region" of the "oil-break."

Roane County, on the headwaters of Pocatalico river of the Great Kanawha and of the southerly branches of the Little Kanawha, had 42 small coal mines worked during the 10th-Census year for local consumption, producing about 800 tons of coal. The mines that furnished 1,000 bushels or more, (70 lbs. to the bush.), were those of R. G. Dorsey, Thos. S. Waters, John N. Rockhold, Oliver Meredith, D. M. Martin, and Moses Stinson. The mines were all in a 2½-ft. bed of bituminous coal. This bed seems, from Dr. Stevenson's "Notes," published in this number, to be the "Brownsville" coal of the Upper Barren group, Rogers' No. XVI.

The Coal and Coke Movement, from the mines, over the Chesapeake and Ohio R'y, for the month of April, 1881, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Mr. Charles M. Gibson, the Fuel Agent for the Company, were as follows:

	1880.	1881.
Fuel for use of Company	10,713	12,813
Shipped at Huntington on the Ohio river	11,483	16,764
Delivered on line of Elizabethtown, Lex'n & Big Sandy RR.	....	2,881
" " Chesapeake & Ohio R'y. west of Richmond	1,831	8,550
" at Williamson to Richmond & Alleghany Railroad.	....	250
" Staunton to Balt. & Ohio Railroad, Valley Division	....	12
" Waynesboro to Shenandoah Valley Railroad	....	115
" Charlottesville to Va. Midland R'y	2,410	4,417
" Gordonsville to do. do.	7	72
" Hanover Junction to R. F. & P. Railroad	1,391	603
" Richmond for consumption, including steam-tugs and dredges	3,949	6,129
Shipped at James River wharves	15,479	23,598
" Newport-News wharves	....	....
Total	47,332	76,204

This statement shows that the movement in April, 1881, was 28,872 tons more than in April, 1880; an increase of over 60 per cent. The increase of shipments by the Ohio was 5,281 tons, one of over 46 per cent. The delivery for local consumption along the line of the C. & O., to supply the wants of furnaces, &c., was more than 372 per cent greater in April, 1881, than in April, 1880; the delivery at James River wharves increased more than 60 per cent. The very large increase in quantities delivered to connecting railways is also worthy of note.

The character of the fuel moved during the same periods, is shown in the following exhibit:

	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Total.
For the month of April, 1881,	1,867	27,844	15,003	24,397	7,093	76,204
" " " 1880,	4,593	38,695			4,044	47,332
Increase, 1881	.....	28,549			3,049	28,872
Decrease, "	2,726	.....			.....	.....

In the "New River and other steam coals" is included the product of the Eagle, and Gauley Mountain mines. The increase in the movement of coke was over 75 per cent.

The fuel movement for the months of Jan., Feb., March, and April—the first four months of 1881, and for the corresponding period of 1880 was as follows:

From January 1st, to	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Total.
April 30th, 1881,	3,348	84,457	55,009	88,490	24,043	255,347
Same period, 1880,	12,152	150,392			11,990	174,534
Increase, 1881,	.....	77,564			12,053	80,813
Decrease, "	8,804	.....			.....	.....

The increase in the first 4 months of 1881 over the same period of 1880 was more than 46 per cent in the total movement, over 51 per cent in that of other coals than cannel, and more than 100 per cent in that of coke, notwithstanding the interruptions caused by the unusual weather of the early part of 1881.—The constant increase in the coke traffic is due to the large and constantly increasing demands of Virginia blast-furnaces, and that increase would be doubled if the Low Moor consumption appeared in the returns as coke and not as New River coal as it now does; for that Co. makes from 2,500 to 3,000 tons of coke a month, at its furnace, from coals transported from Beury & Cooper's mine, at Caperton, on New river.

Rogers' Va. Geological Reports.—Persons having copies of these reports for 1836, 1837, 1838, 1839 or 1840, that they will sell at a fair price, can find a purchaser by addressing Jed. Hotchkiss, Staunton, Va.

Virginia's Future in Iron-making.—One of the prominent and well-known iron masters of a northern iron-making state, a friend of the Editor, who has been making quite an extended visit to the mineral districts of Virginia, to one of which we had the pleasure of accompanying him, writes us the following personal letter, on the eve of his departure from Alleghany, our leading iron-making county. We take the liberty of publishing it, for we know that our friend, though a manufacturer of iron in the North, takes a deep interest in the growth of industries everywhere, and especially in Virginia. —EDITOR.

WILLIAMSON, VA., May 20th, 1881.

MAJ. JED. HOTCHKISS,

My Dear Sir—I am just about to leave this section of Virginia for the North, having spent several days in the great mineral belt of Virginia and seen very much to interest me. I will venture the prediction that within ten years Virginia will rank second among the iron-making states of our Union. The completion of the Richmond & Alleghany and the extension of the Chesapeake & Ohio railways will give very great facilities for establishing new manufactories on their lines. I see a grand future for both of them at a very early period. The new town of Iron Gate, just being laid out here, will become one of the most delightful places to visit and make excursions from in all of Old Virginia. The scenery there is unsurpassed, the water is both sweet and healthy, the boating and fishing as well as the hunting, are hard by and can hardly be equalled elsewhere. I am sure that others who come to this section will grow very enthusiastic over the whole ground referred to. I am very sorry not to have seen you again before leaving, but expect to do so ere long. Hoping and believing that the Mining Engineers soon to visit this section will enjoy it as much as I have,

I am, very truly yours,

C. S.

WEST VIRGINIA UNIVERSITY
MORGANTOWN, W. VA., May 16th, 1881.

MAJ. JED. HOTCHKISS, Editor of THE VIRGINIAS:

Dear Sir—I see by the April VIRGINIAS, page 55, that you have called on me for some information concerning the Barbour, Upshur, and Braxton coals, reported by the mining statistics of the 10th census.

I have never examined these regions personally and can therefore give you only probably correct answers from my knowledge of the general structure, and the eastern outcrop of the Pittsburg coal, as given by Rogers and Stevenson.

The mines (20) in the Philippi district, Barbour county, are all, of course, in the *Pittsburg coal*, ("5-ft. bed.")

The 8 in Cove district are most probably in the *Upper Freeport*, (in XIII.)

Those in the Calhoun and Peel-Tree districts ("6-ft. bed") are most probably in the *Pittsburg coal*, while the "7- and 9-ft. beds" of the Corinth and Wilmoth districts are certainly in the *Upper Freeport coal*. This latter bed is everywhere remarkable for its variability in thickness. In Preston county, of this State, I have seen it vary between 4½ and 11 ft. within four or five miles, the same vein being known locally as a "5-ft.," "7-ft." and "9-ft." bed according to its thickness, so that the fact of different thicknesses in Barbour county does not necessarily imply that the coal in the Cove, Corinth and Wilmoth districts represents more than one stratum.

The mines in Upshur and Braxton must belong mostly to the *Pittsburg coal horizon*.

Very respectfully yours,

I. C. WHITE.

Madison Run Iron Ore.—H. T. Douglas & Brother, Madison Run, Orange Co., Va., on Va. Midland Ry., are now working 25 men at their iron mines. They shipped 25 car loads of ore to Grace furnace, Ferrol, Va., in April; they have concluded a contract with Alex. Strausz, of Irondale furnace, Preston Co., Wa., on B. & O. RR., for 1,000 tons of ore within 60 days from April 24, beginning May 1. They expect soon to work 50 hands. The "Railroad" and "Mill" mines which they are now working are very near the railway station.

Summer Resorts.

ROCKBRIDGE ALUM SPRINGS WATER.

These famous medicinal Springs having recently passed into the hands of a Joint-stock Company, it is proposed to place the water on the market at a price bringing it within the reach of the invalid public.

For more than half a century it has grown steadily in repute as a Medicinal Agent in a wide range of Chronic diseases, and prior to the late war it had attained a fame unapproached by any other mineral water in this country.

It first attained celebrity by its complete and unquestionable cure of Scrofula in its worst and most aggravated forms. Cutaneous Eruptive Diseases yielded to its action, and soon Chronic Diarrhœa and Dysentery were added to the list of its conquests. The powerful alterative effects of the water, early attracted the notice of the profession, and many of its most distinguished members have certified to its efficacy in a great variety of depraved conditions of the system, as Torpid Liver, Hemorrhage from the Kidneys, Hemorrhoids, Chronic Bronchitis, Catarrh of the Throat and Nasal Passages, Lesions of the Mucous Membrane generally. Multitudes of women can testify to its unsurpassed efficacy in the relief and cure of those ailments peculiar to their sex. The fine tonic properties of the water give it great potency in all anœmic conditions of the system, invigorating the appetite and increasing and enriching the blood. It has repeatedly proven its efficacy in Diabetes Mellitus, speedily correcting the saccharine depravity of the urine and restoring the wasted flesh and strength of the patient. Probably in no type of disease has its efficacy been better attested or more unfailing than in Dyspepsia in its varied and most distressing forms.

We have from under their hands written statements verifying all and much more than all we have here said, from such acknowledged authorities in medicine as Drs. Cabell and Davis, University of Va.; J. Gaillard Thomas and Thos. Aldis Emmet, New York; Stone and Cartwright, New Orleans The last named having broken in health and lost his hearing by his exposure and labors in Natchez in the first invasion of Asiatic Cholera in this country, spent two years abroad in visiting and studying the most noted spas of Europe. On his return to this country he spent his first summer at the Rockbridge Alum Springs, and ever after as long as he lived he continued to send his patients of the Southern country to these Springs and to order or prescribe the water for them. In a letter addressed by him to the former proprietor, Mr. Wm. Frazier, bearing date "New Orleans, July 28, 1855," after an elaborate comparison of this water, both in its constituent elements and its observed effects, with nearly all the most celebrated mineral waters of Europe, he concluded in these words: "In truth I know of no waters in Europe or America so rich in medical substances as that of your Rockbridge Springs."

And the advertisers wish to emphasize the fact that it was of THIS Spring and none other, that these words were written by that eminent man in science and the healing art.

To list of medical names above printed, we might add a score of other distinguished physicians whose statements will be found in our Springs pamphlet.

This water will be sold in Cases of one dozen half gallon bottles delivered on the cars of the C. & O. Ry. at Goshen, at $5.00 per case, and will shortly be placed with leading Druggists of the U. S. and Canada.

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The new proprietors having appointed me General Superintendent of these contiguous properties, now combined in one, I return (after 12 years absence) to my old field of labor. I wish simply to say that great preparations are now being rapidly pushed to have the premises in very complete and thorough order for the public by JUNE 1ST. I shall spare no pains or effort to keep the the place in the best manner, and to make all its patrons, old and new, thoroughly satisfied and "at home"

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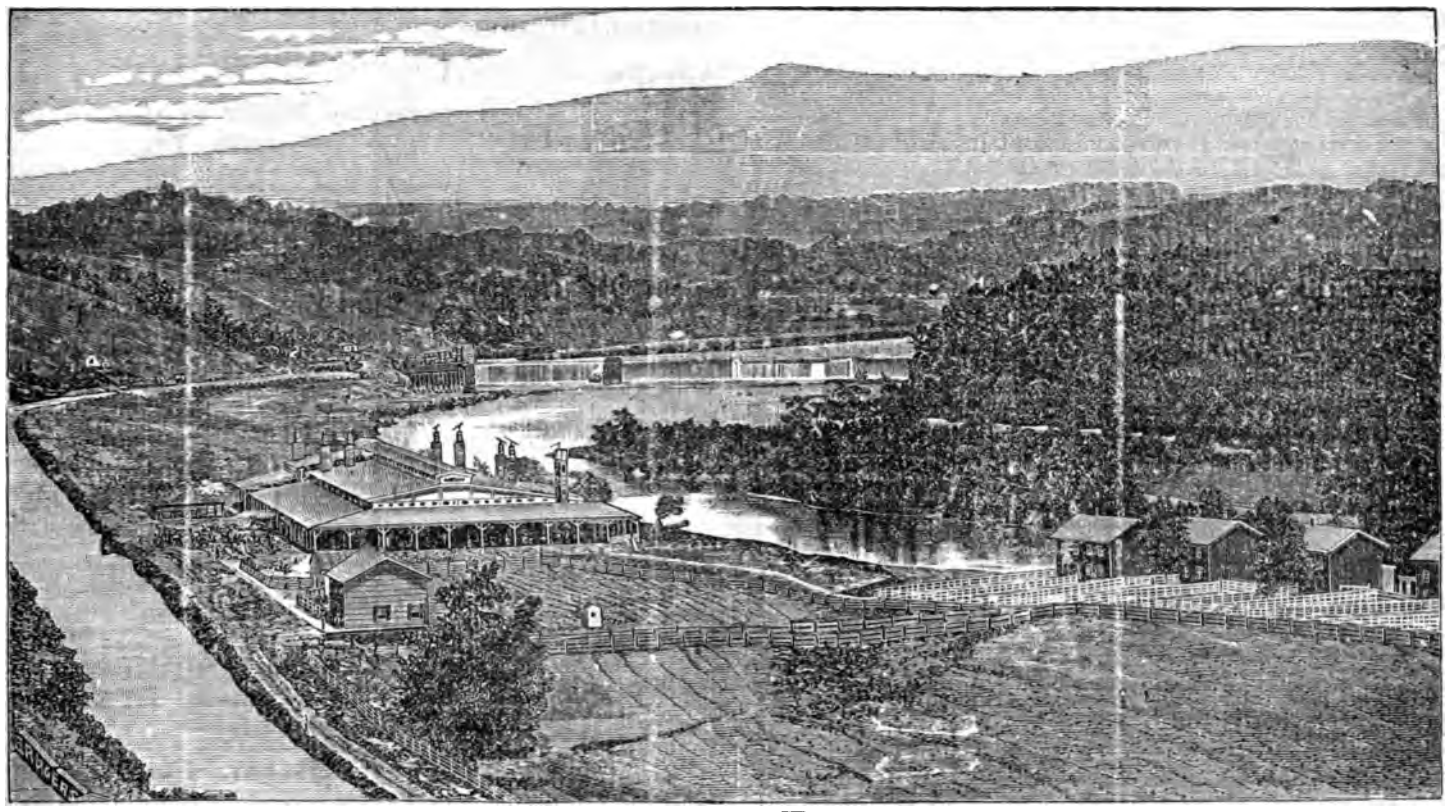

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Iron Quotations at Richmond, Va.—Under date of May 18, 1881, Asa Snyder, furnace agent, reports to *American Manufacturer*, of Pittsburg, Pa., that quotations are nominally unchanged on small orders, but that concessions for future delivery are made on large ones. No. 1 Va. coke iron is quoted $23 to $24.50; No. 2, $22 to $23.50, and Va. cold-blast wheel-iron, $36.00 to $38.00. Freight to Pittsburg $4 on 2240 lbs.

Foreign iron-ore, 120,000 tons in quantity, has been imported at Baltimore since Jan. 1st, 1881, most of it for shipment to central and western Pennsylvania, over the N. Central and Pa. railways. and some by the B. & Ohio. This is chiefly African ore, from Algiers, dug by French convict labor.—It is about time that a proper duty, one that shall put an end to this useless and, especially to the Virginias, hurtful importation, were put on iron ores.

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The Virginia Meeting of the American Institute of Mining Engineers;—What the Newspapers say of it.—As all of our readers, and especially the Virginians, are naturally interested in knowing what impression was made and left upon the minds of the members of the American Institute of Mining Engineers by their recent visit to a portion of the Virginias, and how this meeting here was regarded elsewhere, we make the following extracts from the editorials and special correspondence of some of the more prominent newspapers of the country.

Some of the members in attendance are editorially connected with leading technical journals, as Dr. Rossiter W. Raymond, professor in the School of Mines of Columbia College, New York City, who is one of the editors of *The Engineering & Mining Journal* of New York, and Mr. Charles Kirchoff, jr., of *The Iron Age*, of New York; the articles from those journals are, respectively, from these gentlemen, and they have for these states an especial value.

In the editorial from *The Independent*, of South Pittsburg, Tenn., we recognize the hand of Mr. James Bowron, the manager of the great iron and other works that English capitalists have built up in our sister state; his comparative observations are worthy of attention.

[*Editorial in Engineering & Mining Journal, of June 4th, 1881.*]

"The Meeting of the Institute of Mining Engineers which began at Staunton on Tuesday was a pronounced success from the outset. The attendance of members was very large, and the number of ladies who escorted their husbands and brothers to the meeting was surprising. In fact, the interest taken by Woman in mine engineering and metallurgy is one of the phenomena of the age which philosophers should study. And our boys are the philosophers to do it! The citizens of Staunton displayed a graceful and overflowing hospitality; the weather was delightful up to our latest advices; the papers read were interesting and important; and at the date our informant sent his hasty note, a large and merry party was starting down the Shenandoah Valley to visit and dine at the Luray Cave."

[*Editorial Correspondence, Engineering & Mining Journal of June 11th, 1881, by Dr. R. W. Raymond.*]

"WHITE SULPHUR SPRINGS, W. VA., June 4, 1881.

"The memorable Virginia meeting of the Institute is over; and so crowded has it been with delightful and interesting events that the attempt to set forth its salient points proves almost impracticable. The proposition is itself absurd. When a figure has an infinite number of salient points, it hasn't any—every geometer knows that! Yet perhaps we get around the difficulty of enumeration by the scientific device of classification. At all events, we will try this way of escape.

"The characteristic features of this meeting have been, first, the unbounded hospitality of the citizens of Staunton, where it began, and of numerous residents and corporations in the two States through which it has extended; secondly, the extraordinary length of the excursions—the total, from the commencement at Staunton to the end at White Sulphur Springs, amounting to over 700 miles—and the magnificent scenery which they exhibited; thirdly, the surprising and suggestive revelation, afforded to many of us, of the mineral resources of this region and the rapid development which they are receiving. We were about to add, fourthly, the good time that everybody has had; but that goes without saying. It has come to be the inevitable feature of an Institute meeting; and though it might impress an outsider as the special character of this one, we veterans can only say that we have had the usual good time, simply emphasized by large numbers and novel and beautiful surroundings.

"Professionally, the meeting took its tone from local circumstances, as was proper and to be expected. The great steel-rail question, which has absorbed so much attention for several meetings past, aroused but little debate this time, though several not unimportant contributions to its discussion were presented, including communications from Akerman and Sandberg. Heinrich's paper on the practical working of the ammonia-soda process (appropriate to the West Virginia salt region), Egleston's on the Ore Knob copper process, Frazer's on the ores of the Upper James, Dewey's on the Rich Hill iron ores and the Falling Cliff zinc mine, Sharples' on the occurrence of black band iron ores in West Virginia, and above all, Hotchkiss' account, begun in a paper at one of the sessions and continued in a running talk through every day of the meeting, of the geology, mineral resources, and industries of the Virginias, were the leading themes of the occasion. All of them concerned the development of the South. Nothing could be more thorough and complete than the way in which, by the distribution of maps and statistical and descriptive *brochures*, members were furnished with the means of gaining a clear conception of the resources and enterprises of the South. Little was said about the Southern gold belt; the meeting did not cover any part of that territory; but the iron, coal, copper, timber, geology, and topography of the Blue Ridge, the Great Valley and the coal fields on the New River and the Kanawha, were admirably illustrated and expounded. Copies of Major Hotchkiss' excellent journal, THE VIRGINIAS, now in its second year, a perfect treasury of information on these subjects, did good service in this respect; and the gallant Major himself did still more. Perfectly acquainted with the ground, and a good as well as a willing talker, he poured forth to fascinated listeners an inexhaustible stream of description, explanation, and anecdote, the latter largely connected with the famous campaigns of Stonewall Jackson, whom he accompanied as topographical engineer. The Major carried his geology into war, and war is inextricably associated with his geology. He remembers how his corps charged 'across that Trenton limestone;' how he climbed with many bruises a mountain of 'that confounded Medina sandstone;' how victory perched on the Silurian and defeat lurked in the Trias.

The chemists had their innings in several important papers, particularly with regard to the determination of manganese in iron and steel. A paper by William Kent presented the results of a manganese-symposium, that is, the independent determination of manganese in a certain piece of metal, by a number of different chemists, coupled with a note of the method employed by each. As the results were in some cases strongly discordant, the whole exhibit illustrated well the differences that exist among men, and among methods, in such work, and the discussion brought out from Drown the mention of a source of error hitherto unsuspected, namely, the presence of manganese in the coarser Swedish filter-paper.

Many valuable papers, read by title only, and consequently not influencing the atmosphere of the meeting, we pass by, referring our readers to the list already published.

We have alluded to the hospitality of the citizens of Staunton. The reception of the Institute in this beautiful mountain city has scarcely been paralleled at any former meeting, if the size of the town be taken into consideration. Staunton is principally noted for its lovely scenery and salubrious climate, and for the schools and public institutions which for that reason have been gathered in and about it. At one of the latter, the Asylum for the Deaf, Dumb and Blind, a brilliant evening entertainment was given. The extensive and beautiful grounds, overlooking the city, were illuminated with innumerable colored lanterns; a large hall, tastefully decorated with flags and mottoes, was occupied for promenade, conversation, and music by the famous Stonewall Jackson band; while in another spacious apartment was served the supper, prepared by the hands of the Staunton ladies, who waited in person upon their guests. So profound was the impression produced upon the members by this overflowing and graceful courtesy that the Council resolved upon an extraordinary acknowledgement of it. On Wednesday night, there was in the Staunton Opera House an amateur performance of *The Pirates of Penzance*, in aid of a fund for the care of the cemetery, in which lie buried many of the Confederate soldiers. The Institute attended the performance in a body; and between the acts, by permission of the managers, and with the cordial appreciation of the audience, a representative of the Institute attempted to express, so far as words could do it, the thanks of the members, particularly to the ladies of Staunton. On the following morning, we left with mutual regret our new but hearty friends.

Before this, however, by the kindness of the Shenandoah Valley Railroad Company, we had enjoyed a remarkable trip down The Valley, passing many points of historic interest (including the forges of the Shenandoah Iron-Works), and reaching the climax of surprise and pleasure in a visit to the Luray Cavern. This wonderful grotto has been known but a year or two, and has been but recently made easily accessible. It is one of the most beautiful in the world—large enough for imposing sublimity and bewildering variety, yet not so large as to fatigue the visitor. In abundance of stalactitic and stalagmitic forms, it can scarcely be surpassed; and illuminated as it was for this occasion with countless starry lights, it presented a picture of grotesque splendor which none of us can forget. It is safe to predict that this cave, so lovely in itself and so easily reached from the great Atlantic cities, will become the resort of thousands of visitors every season. It is worth a pilgrimage to see it.

The Chesapeake & Ohio Railway Company furnished for the journeyings of two days and part of a third (aggregating over 250 miles) a handsome special train, in which we traveled on Thursday, June 2d, from Staunton to White Sulphur, stopping on the way at the furnaces of Ferrol, Longdale, Clifton Forge (where, by the way, there is neither forge nor furnace, but where there are mines), and Low Moor. At Longdale and Low Moor, an oppor-

Indian Rock Limestone.—Mr. Charles L. Wilson, of Buchanan, informs us that Col. Dillon is now burning 225 barrels of lime a day, or over 50,000 a year, from the quarries near Indian Rock, Botetourt county, Va., on the Richmond & Alleghany RR., about 6.5 miles below Buchanan. The cost of making and selling this lime, Mr. W. says, is about $0.60 a barrel, and it sells at from $0.90 to $1.10. Col. D. also ships a large quantity of this limestone to Lynchburg for use in the blast-furnace there.—Mr. W. thinks that this heavy bed of limestone (which is quarried at Indian Rock, and which is exposed for several miles farther down the river, notably near Rocky Point Mills, 3 miles down, where Roaring run falls over a ledge of it 200 ft. wide and 60 ft. high) is the "Coralline bed" of formation No. III, described by Prof. Campbell on p. 44 of THE VIRGINIAS for 1880, as an "old coral reef," that has here, along the James, a much larger development than elsewhere in this region, to which Prof. Campbell thinks it may pertain exclusively. It is said to contain 95 per cent of lime carbonate. This clear gray crystalline limestone attracted the attention of Prof. Rogers as a marble, many years ago, and he had some of it polished and found it beautiful. The beds on Roaring run are said to be sufficiently heavy and compact to admit of taking from them blocks of almost any desired size. The *blue limestone* of The Valley, equally pure, is here found in thick beds adjacent to the "coralline". It would appear from these statements that the locality offers very great advantages for lime-burning, marble-quarrying, flux-supplying, etc., now that the Richmond & Alleghany RR. brings cheap coal and places it within reach of many markets. We hope men of experience and capital will utilize these limestone resources.

The Coal and Coke Movement, from the mines, over the Chesapeake and Ohio R'y, for the month of May, 1881, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Mr. Charles M. Gibson, the Fuel Agent for the Company, were as follows:

	1880.	1881.
Fuel for use of Company	11,540	12,043
Shipped at Huntington on the Ohio river	12,046	21,716
Delivered on line of Elizabethtown, Lex'n & Big Sandy RR.	....	3,392
" " Chesapeake & Ohio R'y. west of Richmond	1,837	10,452
" at Williamson to Richmond & Alleghany Railroad.	....	30
" Staunton to Balt. & Ohio Railroad, Valley Division	....	....
" Waynesboro to Shenandoah Valley Railroad	....	172
" Charlottesville to Va. Midland R'y	4,416	5,125
" Gordonsville to do. do.	....	12
" Hanover Junction to R. F. & P. Railroad	1,010	636
" Richmond for consumption, including steam-tugs and dredges	2,973	7,873
Shipped at James River wharves	16,639	21,175
" Newports-News wharves	....	....
Total	50,461	82,986

The movement in May, 1881, was 32,525 tons more than in May, 1880; an increase of over 64 per cent. It was 6,782 more than in the preceding month, April, 1881, or over 9 per cent. The increased quantity used by the railway indicates the increased amount of business it is doing. The figures show over 80 per cent gain in the shipments down the Ohio in May, 1881, over May, 1880,—foreshadowing, in a very small way, the enormous increase in coal freightage that will accrue to this railway as soon as its direct, down-grade, all-rail connections are made with Cincinnati so that the superior coals of the Great Kanawha basin can be sent to that market without transhipment and having in their favor more than 100 miles of air-line and over 200 of actual haulage. The delivery to the E. L. & B. S. RR. indicates also the westward tendency of the coal traffic.

The increase of over 526 per cent in the quantity of coal delivered for use on the line of the railway in May, 1881, over May, 1880, is a measure of the growth of the iron manufacture during the intervening year, a growth that, from present indications, has but just begun and that will here, in the near future, expand to very great proportions, so favorable are all the conditions for its growth.

Richmond increased its consumption of Kanawha basin coal nearly 165 per cent; figures that indicate the present growth of the industries of that prosperous city, one richly endowed with natural advantages for becoming one of the great manufacturing and commercial centres of the country.

The shipments from James River wharves, the trade in Kanawha basin coals to Atlantic seaboard cities, increased over 27 per cent, a handsome gain, but nothing, in our opinion, to what it will be a year hence when great collier ships will receive it from the Newports-news wharves.

The character of the fuel moved during the same periods, is shown in the following exhibit:

	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Total.
For the month of May, 1881,	1,926	32,985	15,407	25,938	6,730	82,986
" " " 1880,	3,714	44,473			2,274	50,461
Increase, 1881	.....	29,857			4,456	32,525
Decrease, "	1,788	.....			.....	.....

In the "New River and other steam coals" is included the product of the Eagle, Hawks Nest and Gauley Mountain mines. The increase in the movement of coke was almost 200 per cent.

The fuel movement for the months of Jan., Feb., March, April and May—the first five months of 1881, and for the corresponding period of 1880 was as follows:

From January 1st, to	Cannel.	Gas.	Splint & Block	New R. & other steam.	Coke.	Tota
May 31st, 1881,	5,274	117,442	70,416	114,428	30,773	338,333
Same period, 1880,	15,866	194,866			14,263	224,995
Increase, 1881,	.....	107,420			16,510	113,338
Decrease, "	10,592	.....			.....	.....

The increase in the first 5 months of 1881 over the same period of 1880 was more than 50 per cent in the total movement, over 55 per cent in that of other coals than cannel, and more than 115 per cent in that of coke, notwithstanding the interruptions caused by the unusual weather of the early part of 1881.—As we have before stated, the constant increase in the coke traffic is due to the large and constantly increasing demands of Virginia blast furnaces, and that increase would be doubled if the Low Moor consumption appeared in the returns as coke and not as New River coal as it now does; for that Co. makes from 2,500 to 3,000 tons of coke a month, at its furnace, from coals transported mainly from Beury & Cooper's mine, at Caperton, on New river.

La Belle Iron Works Co., Wheeling, Ohio Co., W. Va., of which W. H. Woodward is president, mined during the 10th-census year some 17,000 tons of bituminous coal from a 5½-ft. bed on its own lands, for use in its iron works. Its mines, which have an annual capacity for producing some 30,000 tons a year, are located in Wheeling Centre. These mines during the years 1874 to 1879, inclusive, yielded about 120,000 tons (2,000-lbs) of coal, an average of 20,000 a year, all of which was consumed in the company's iron works.

The Belmont Nail Co., of Wheeling, W. Va., works a coal mine in a 5-ft. bed of bituminous coal that was opened in 1848. During the 10th-census year it mined some 25,500 tons of coal, employing from 40 to 50 miners, for use at its iron works in Wheeling. Its mines have a capacity for producing some 40,000 tons of coal annually.

The Iron & Steel Association of Va., W. N. Page, financial manager, has completed the surveys for its railway from Goshen, on Ches. & Ohio Ry., to its mines near Rockbridge Alum Springs, Rockbridge Co., Va., and the work of construction has begun. Brick-makers are at work, near the furnace site, and other work is in progress. Everything is being done that ample means and well directed energy can do to make as rapid progress as possible in the construction of the very extensive works provided for by the plans of this company, of which we wrote fully in our April, 1881, issue.

Tellurium Gold Mine, and Va. Gold-mining.—Recently the Gov. of Va. received a letter from Alfred G. Lock, Fellow of the Royal Geological Society, of London, Eng., who is preparing a work on Gold-mining, asking for information in reference to gold-mining in Va. This letter has elicited one from Dr. Wm. B. Gray of Richmond, Va., to Dr. Pollard, Comm'r of Agr., which we find in the *Central Presbyterian*, of June 15, 1881, giving information concerning the Tellurium gold-mine, near which Dr. G. was raised, and which he says is the oldest gold-mine in the State. He adds some comments on gold-mining in Va.—The substance of this letter is as follows:

The Tellurium Gold-mine is about 5 miles from Columbia station, of Richmond & Alleghany RR. The estate pertaining to the mine is 344 acres, mostly in Fluvanna county, but partly in Goochland. Geo. Fisher, Sr., discovered the mine about 1832, and in 1834 he and his sons and Judge D. W. R. Bowles leased it; they worked it, continuously and profitably, until 1848, when it was sold to Com. R. F. Stockton, of N. J.

Geo. Fisher, jr., informed Dr. Gray that there are three gold-bearing veins here; the "big sand-stone," the "middle" and the "little" veins. They run N. E.-S. W. and dip 20° to to 30° E. The average value of the ores from the "little" and the "middle" veins, the ones worked during the 14 years of the Fisher-Bowles lease, was $100 per ton,—the minimum $5, the maximum $300. The gold-bearing matrix is slate, quartz, brown oxide of iron, tellurium, etc. Sulphurets are abundant, but not to any great extent in these 3 veins.

Com. Stockton worked the "big sandstone" vein, almost exclusively, for 9 years; his mine boss put the value of ore raised as $20 per ton.—The deepest shaft is 120 ft.; the others will not average 45.

This mine was recently leased by its owners, "The Columbia Gold-mining Co.," Hon. A. M. Keiley, Pres., to a Northern man; it was reported, early this year, that he was saving $7 a ton from the "sandstone" vein ore.

A 10-stamp California mill, with amalgamated copper plates to save the gold, is now used at Tellurium. Dr. G. believes that 40 per cent of the gold is lost by this amalgamation method, although it has been and is the one generally used in Va., (at the Snead mine in Fluvanna he understands that chlorination is being tried), because much of the Va. gold is very fine and cannot be saved by amalgamation and the wet crushing that is generally practiced. A better and cheaper *saving process* is needed. Dry crushing is advocated because the gold on a good many properties is lamellated and the particles are so thin and delicate they are readily carried off by water. A case will illustrate. Prof. M. H. Stowe, of Washington, D. C., assayed some Tellurium mine ore by crushing it and passing it through a 60-holes to the inch seive, then agitated in water and allowed 30 seconds to settle, the water was then poured off, filtered, rinsed and dried, when it yielded $38.98; this with the gold that subsided made the ore worth $88.06.

The average value of Va. gold ores, in Dr. G's. opinion, is from $5 to $15 per ton; the ores are abundant, and he does not recollect seeing any from an acknowledged gold mine run under $4 per ton. An assay of 50 tons of Tellurium ore gave, the lowest $4.80, the highest $137.50, averaging $51.22.

The cost of mining and milling gold ores at the Ellis mine, Va., made up from carefully kept itemized records, was stated, by Prof. Stowe, to be $2.20 per ton.

The "Virginia Burke Rocker," popular in Va. for "placer," or "surface" washing, is described as being "like a closed infant's cradle, made water-tight, open at the top and provided with a perforated sheet iron bottom (false and above the true bottom), and a chamber below, charged with mercury for purposes of amalgamation. The whole is placed upon rockers for agitation of gravel, etc., with water which is kept constantly pouring over it."

Mr. Wm. F. Kirtley, a miner and prospector for gold, has recently written two letters, from the Tellurium Gold-mine, to Hon. A. H. H. Stuart, who has kindly placed them at our disposal. Mr. K. calls attention to the immense quantities of gold-bearing quartz and alluvial gold deposits in Va., and thinks that these, although of low grade compared with those of the West, can be more profitably worked because we have cheaper and more abundant labor and greater facilities for transportation. The California ores that yield from $5 to $10 per ton pay handsome dividends. He finds that the Va. quartz yields in milling from $3 to $5 per ton; assays run higher, but the best test of value is obtained by milling the quantities upon which the estimate is to be based. The alluvial deposits of Va. yield from 25 cts to $1 a cubic yard, and money can be made in handling material with such values, as he has proven at the Belzoro mine in Goochland, where he proposes to put up a quartz mill.

W. Va. Central and Pittsburg R. R.—We find the following item and comments in the Baltimore *Sun* of June 27, 1881: The stockholders of the West Virginia Central and Pittsburg Railway Company met at the office of Shaw Bros., Maryland Building, Saturday, and elected Hon. Henry G. Davis, president, S. B. Elkins, vice-president, C. M. Hoult, secretary and treasurer, and the following board of directors: Alexander Shaw, Baltimore; Hon. Augustus Schell, New York; Hon. Jas. G. Blaine, Maine; Hon. Wm. H. Barnum, Connecticut; Hon. S. B. Elkins, New York; Hon. J. N. Camden, West Virginia; Wm. Keyser, and Jno. A. Hambleton, Baltimore; Thos. B. Davis, West Virginia. Mr. Wm. Keyser presided, with Mr. C. M. Hoult, secretary, and among those present were Secretary of State James G. Blaine, Senator T. F. Bayard, of Delaware; Senators H. G. Davis and J. N. Camden, of West Virginia; Senator A. P. Gorman, of Maryland; Hon. Wm. Pinkney Whyte, S. B. Elkins, T. E. Sickels and Augustus Schell, of New York; John K. Shaw, Alex. Shaw, W. T. Poole, W. C. West, R. C. Hall and others, of Baltimore. Among the prominent stockholders, other than those mentioned above, are Hon. Wm. Windom, Secretary of the Treasury; J. B. Chaffee, R. C. Kerens and U. S. Grant, Jr., of New York.

The company was formerly known as the Potomac and Piedmont Coal and Railway Company, and was owned and controlled by Messrs. H. G. Davis & Bro., of West Virginia, and Messrs. Shaw Bros., of Baltimore. By an act of the West Virginia Legislature, at its last session, the name was changed to that of the West Virginia Central and Pittsburg Railway Company. The road is of the standard gauge, and connects with the Baltimore and Ohio Railroad at a point near Piedmont, about 200 miles west of Baltimore, and is about completed to Elk Garden, a distance of twelve miles. Here the company owns a large body of coal lands, containing what is known as the great or fourteen foot vein, and is now opening mines and connecting them with the main road by inclined planes, and by the 1st of September will be ready to place this coal in the market. Besides this, the company owns 25,000 acres of coal, ore and timber lands in fee in the Piedmont or Potomac coal basin, and it is now its purpose to immediately extend its line from Elk Garden south, through its coal fields, up the north branch of the Potomac through Mineral and Grant counties, thence to the southeastern boundary of the State of West Virginia, there to connect with the Richmond and Alleghany Railroad. The main line, when completed, will be above 160 miles long, and will connect the Baltimore and Ohio, the Chesapeake and Ohio and the Richmond and Alleghany railroads by a direct line north and south. The first fifty miles of the line runs without a break through coal and timber lands, after which it reaches the great iron deposit of West Virginia and Virginia. The capital stock of the company is $6,000,000, and is all taken, the directors being largely interested. The company propose to issue $3,000,000 bonds. In addition to its railroad and mining rights, the company possesses the right, in the charter, to build manufactories, saw-mills, furnaces, &c. It has a contract with the Chesapeake and Ohio Canal Company, by which a drawback of ten cents per ton below its lowest rate is offered on all coal shipped by the railway company to the canal at Cumberland. Messrs. Shaw Bros., of this city, have consented to act as the general agents of the company and to take charge of its mining interests. Mr. T. E. Sickles, formerly chief engineer of the Union Pacific Railroad, and now consulting engineer, is to take charge of the works, and the road will be pushed to early completion.

We may add to the above by stating that this very important railway line connects with the B. & O. R. R. near where it crosses and leaves the North Branch Potomac, in going west, and then follows North Branch for 40 or 50 miles, to its source, through the southward extension of the Cumberland, or Potomac coal-basin, in Mineral and Grant counties, (See Geol. map in June 1880, No. of *The Virginias*), where the head-streams of the North Branch, either Stony river or Maryland creek, interlock with the waters of Black Fork of Cheat river, in the "land of Canaan," and give passage way to that river, near its Dry fork mouth, and to the route down it for the Pittsburg branch of the railway, through Tucker, Preston, and Monongalia counties, W. Va. From the Potomac-Cheat junction southward the route will probably be up the Greenbrier limestone valley of the Dry Fork of Cheat, in Randolph county, to some favorable point, as by Gandy creek, for crossing Alleghany mountain to North Fork of South Branch Potomac in Pendleton county, W. Va., thence by way of the Dry runs of North Fork and South Branch, through a Valley limestone country, to South Branch, near the Pendleton-Highland (W. Va. line), thence through Highland, by way of Crab run to McDowell, on the Bull-pasture, then down that river to the Cow-pasture, in Bath, whence it may follow that river, across Bath and Alleghany, to the Richmond and Alleghany R. R. at the head of the James at the mouth of Cow-pasture, or cross to Mill creek of North River and go through Panther and North River gaps, by Goshen, and down North river to Lexington.—We have not space now to comment further. We are delighted at the prospect opened by this great railway enterprise for the development of large undeveloped areas of the Virginias, and shall have more to say upon this subject hereafter.

(*Continued from page* 83.)

method, Mr. Mackintosh found that it gave results showing positive errors averaging about 1 per cent. The excess in weight was found to be due to the fact that so-called allotropic copper was found similar in physical properties to that described by Schützenberger. The latter, however, found 5 to 10 per cent. of suboxide of copper in this "allotropic copper," while Mr. Mackintosh found carbon and hydrogen, the relation between which was important. Synthetical experiments indicate the presence also of nitrogen. The practical results is that in nitric acid solution the presence of organic matter makes the electrolytic method by Luckow inaccurate. Prof. Egleston made some additional remarks on the importance of the paper and the effect of impurities upon the electrical and other uses of copper.

Mr. Sharples, of Boston, stated that in Dr. Gibbs' laboratory the electrolytic method was tested by him a year before Luckow had published it, and they found that a little quantity of nitric acid did no harm, and could be counteracted by ammonia. He described the method now used by him in copper analyses, which he thought bids fair to become the standard method. Prof. Frazer and Mr. R. W. Raymond joined in the discussion, and the latter made an effort to obtain some facts as to the impurities affecting the conductivity for electricity of copper and the possible conclusion which might be drawn therefrom in relation to iron wire.

Prof. Frazer closed the session by reading a paper on a new geological map of Chester county, Pa.

Second Session.—The session on Tuesday morning was opened by a paper on the "Ore Knob Copper Process," by Prof. T. Egleston, of New York, in which he described the nature of the copper deposit of Ore Knob, Ashe county, N. C., and the work done to develop it. The run of the mine in the outcrop was fully 30 per cent, but the mines have grown poorer in depth. It pays at Ore Knob to treat 3 per cent ores, as from this ore ingot copper can be placed on the market for 12.5 cents per pound, while on Lake Superior, so far as is known, it costs 10.5 cents to make ingot copper. The run of the Ore Knob mine was found by Prof Egleston to be 3.5 to 4 per cent for certain parts of the belt. The ore cannot be dressed, and only some hand picking can be done, although more could be effected in this direction. As the ore contains much lime, the wet processes have been discarded, and the process now adopted is roasting the picked ore and dressed fines in piles with cheap oak wood. The roasted ore is melted in shaft furnaces for mattes, generally called single mattes, which are again roasted in piles. The wasted matte is again melted for black or pig copper, which is followed by fining and refining. The special features of interest in connection with the metallurgical operations is the treatment of the salamanders formed in the smelting and the refining which is carried out in a reverberatory furnace heated with wood. The cobalt and nickel, about 1 per cent, are separated by being carried into the refinery cinder obtained during polling, which must be of a special composition. This allows the copper to be carried to great purity.

Mr. Jed. Hotchkiss spoke, during the discussion, on the wealth of copper ore in Virginia, which when first examined many years ago by distinguished geologists, was not opened out because of lack of transportation facilities, which lack is now being overcome rapidly. The discussion, in which a number of gentlemen participated, drifted into a consideration of the question whether it would not be possible to utilize the sulphur in these ores for the manufacture of sulphuric acid on a large scale.

The next paper was by Mr. Fred. H. Williams on the Volumetric Estimation of Manganese in Pig Iron, Steel and Spiegeleisen.—The object of this paper is to bring to the attention of those members of the Institute who are interested in the subject, a method for the estimation of manganese which has been frequently used in the laboratory of the Vulcan Steel Works during the last eight months, and which is deemed worthy of more general use. It is simply an adaptation of well-known processes for the purpose of determining this element in pig iron and steel. In general, the method consists in pecipitating the manganese as binoxide, dissolving that in dilute sulphuric acid in the presence of an excess of a standardized solution of oxalic acid, and triturating the balance of the oxalic acid left unoxidized with permanganate of potash.

The following letter by Prof. Richard Akerman, of Sweden, was read: "I agree with Sandberg's views that it is too early yet to stipulate only one certain chemical composition in the rails. Such a composition, I think, could be more justified if it was not for the manganese, but this metal changes the properties of the iron and steel in the same direction as carbon, silicon and phosphorus by increasing its tensile strength, stiffness, hardness and brittleness. If the iron or steel does not only contain carbon and manganese, but also phosphorus, silicon and sulphur, I think everybody will agree that the manganese, to a great extent even, can neutralize not only the tendency to red-shortness caused by the sulphur, but also the tendency of the iron or steel to become burnt and brittle, caused by the phosphorus and silicon. Thus brittleness can be as well increased as decreased by the presence of manganese, and I therefore consider that, however necessary analyses now and then may be in order to enlighten us and explain exceptional cases, yet they are not convenient as practical tests upon rails, especially as the properties of the rails not only depend on the chemical composition of the iron or steel, but to a great extent also upon the soundness of the ingots and the mode of manufacturing the rails. Still less necessary than analyses, I regard the German system of controlling the rails by researches or contraction of area. I do not consider either the elongation or the contraction of area in fracturing samples to test tensile strength gives a correct idea of the toughness of iron or steel. On the contrary, I regard the falling test, properly carried out, to be much better in this respect, and to give a greater safety against breakage than the common tests on tensile strength.

A communication from C. P. Sandberg on Steel Rails and Steel Blooms was read by the Secretary, in which the writer adds to the discussion at Philadelphia and gives his views on the questions involved as obtained by long experience. We shall print an abstract of this paper at an early date.

Dr. Raymond thought that Dr. Dudley's data required additional mathematical discussion. Assuming an algebraic form of the function and working out the 64 equations obtained by the method of least squares, Mr. Raymond found that the coefficient of the carbon was over half of the phosphorus, and that manganese, for which a negative result was found, behaved much like iron, while silicon, also negative, was also rather a softener than a hardener, though the coefficient was small. He thought that this mathematical discussion settled the theory of phosphorus units.

Dr. Dudley, in conclusion, stated that after he had had time to read and digest the discussion he would at a future meeting make a final rejoinder. He stated that a direct experiment was now being made with 40 rails.

Third Session.—In the afternoon the members met in the rooms of the Young Men's Christian Association, and Mr. S. P. Sharples, of Boston, State Geologist of Mass., was called upon to read his paper on the "Occurrence of Black Band Iron Ores in West Virginia." He stated that the existence of black band ores in that section had been doubted, and even in the locality referred to, Davis Creek, Kanawha county, W. Va., conflicting statements were made. Mr. Sharples examined the property and found these ores seemingly identical with the famous Scotch black bands, carbonates of iron, with a large admixture of coal. In the case of the Davis Creek deposit, which is from 4 to 6 feet thick over a known area of at least 1,000 acres, the coal is partially finely mixed with the iron ore and partially interstratified with it, two of the strata being at least 2 inches in thickness. An analysis of the ore is given below, and for comparison two analyses of ore from the Helen Mine, Hocking Valley, and from Llanelly, Wales, are added:

	Davis Creek.	Helen, Hocking Valley.	Llanelly, Wales.
Silica	3 60	4.93	7.20
Phosphorus	0 25	0.87	0.295
Sulphur	0.41	1.07	0.26
Metallic iron	31 46	36.43	33.68
Roasted ore.			
Metallic iron	64 pr. ct.	50.80	56.00

In addition to this ore the tract where it is found contains several veins belonging to the lower measures, one of which is about 10 feet thick, and contains by analysis 58 per cent of fixed carbon, 38 per cent of volatile matter, 3.8 per cent of ash and 0.72 per cent of sulphur. It had been asserted by some that this ore could not be worked, and Mr. Sharples brought the matter before the Institute to ascertain what experience had been had in using the West Virginia, Kentucky, and principally, also, the Ohio black band ores. No one present appeared to be in a position to give any data on the subject, and the president called upon Mr. F. P. Dewey, of Chattanooga, for his paper on the "Rich Hill Iron Ores and the Falling Cliff Zinc Mine," both deposits found in Southwestern Virginia.

Rich Hill Iron Ores.—Rich Hill is situated in the famous car wheel iron region of Southwest Virginia, and although it contains other ores, this paper is devoted chiefly to its car-wheel ore. The ore has been very thoroughly tested by exploration

The Norfolk & Western and Shenandoah Valley Railroads.—Illustrated by Map Showing their Lines and Connections.

In May last, when the great Virginia railway that had been known as the Atlantic, Mississippi & Ohio passed into the hands of a new company and became the Norfolk & Western Railroad, it was our intention, as stated in a previous issue, to present some facts concerning the present condition and traffic of this railway and its relations to other railways of the country, together with some general statements concerning the character and resources of the Virginia territory naturally tributary to it, with special reference to what it has already done and to what, in our opinion, it may hereafter do in developing these great and varied resources and in building up the mining, commercial, manufacturing, and other industries of the state,—embracing in the same general view the Shenandoah Valley Railroad which is, essentially, under the same management, and which will become during this year, by the completion of its southward extension, a part of the Norfolk and Western system of Virginia railways.—Our intention, which we now proceed to realize, was then frustrated by the delays that occurred in the preparation and publication of the accurate and carefully engraved topographical and railway map, designed for the illustration of that article, which accompanies this June issue but is headed "Supplement to THE VIRGINIAS for May, 1881."

The Norfolk and Western Railroad Company was organized May 3rd, 1881, with the following officers and directors:

OFFICERS:

President . . . . . George F. Tyler.
First Vice-President . . . . . F. J. Kimball.
Second Vice-President and General Manager . . . . Henry Fink.
Treasurer . . . . . Wm. G. Macdowell.
Secretary . . . . . G. R. W. Armes.
Auditor . . . . . E. E. Portlock.

DIRECTORS:

George F. Tyler,	Philadelphia.	H. Victor Newcomb,	New York.
Clarance H. Clark,	"	W. B. Isham, ...	"
F. J. Kimball, . .	"	C. D. Wood, ...	"
E. A. Rollins, . .	"	U. L. Boyce, . .	Boyceville, Va.
C. C. Baldwin, . . .	New York.	J. B. Whitehead, . .	Norfolk, "
G. C. Clark, ...	"	J. Arthur Johnston,	Petersburg, "
Robert B. Menturn, .	"		

The Norfolk and Western Railroad consists of a main line, of 408 miles, extending from Norfolk, Va., to Bristol, Tenn.; a branch, 10 miles long, from Petersburg to City Point on the deep water of the James; a branch, 10 miles long, from Glade Spring to the salt-works and plaster-banks at Saltville; making 428 miles of main line. Its sidings amount to 35 miles; so it has 463 miles of track of 5-feet gauge.—Steel rails are laid on 231 miles; the whole road bed is well ballasted; the bridges are substantial structures, the principal ones being of iron. The physical condition of the road is, in all respects, excellent. Its rolling stock, on the 1st of May, consisted of 85 locomotives, 42 passenger, mail, and baggage cars, and 1,008 freight cars; the number of each of these has of late been materially increased.

The financial condition of this railway is a matter of much importance to us, for on that depends its ability to aid in the development of Virginia; of that a few words.—Its authorized capital stock is $18,000,000, divided into $100 shares; $15,000,000 preferred stock and $3,000,000 common.—It is mortgaged to the Fidelity Insurance, Trust and Safe Deposit Co., of Philadelphia, as trustees, by a general mortgage for $11,000,000, secured by 11,000 bonds of $1,000 each, due May 1st, 1931, bearing 6 per cent interest payable semi annually May 1st and Nov. 1st at the office of the company in Philadelphia. Of these bonds $4,500,000 are held by the trustees for payment of bonded indebtedness of the roads consolidated to make the A. M. & O., $500.000 are held by the company for future use. The statement is officially made that the interest-bearing bonded indebtedness of the company (May 1st) is but $10,278,600. for the interest of which $660,696 must be provided annually.—The net earnings of this railway for the year ending June 30, 1880, over and above all expenditures (including $150,860 for repairs and betterments), were $923,107. It was estimated that the net earnings for the year that has just closed would be $1,058,906; figures that have probably been reached if not exceeded.—These statements show that this company is in a prosperous financial condition, and we may endorse the statement of this company to the New York Stock Exchange, when it stated:—"It is therefore believed that with the railroad in thoroughly first-class condition, with increased equipment and terminal facilities, the traffic of the line will be largely increased. The rapid development of Virginia's commercial, mineral, and other resources, which will be fostered by the Company, will be an important factor of this result."

Its revenues are steadily and rapidly increasing. In 1866–7, its revenues were $1,054,000; in 1879–80 they were $2,022,000,—a gain of almost 100 per cent in the interval. The present year will probably show a revenue of some $2,250,000.—Its *tonnage* in the past 8 years has increased from 322, 400 tons to 456,700, a gain of over 40 per cent; one that the business of the year just ended will still further increase.

The mineral and metal traffic of the railway in 1870 was 3,175 tons; in 1880 it was 28,767 tons,—that of 1880 being more than 9 times that of 1870. The returns for the first quarter of 1881 show in this traffic a gain of more than 53 per cent on that of the first quarter of 1880.—This traffic, as every one that has any idea of the mineral resources of the tribuary country knows, is as yet in its infancy. We look to a doubling of its amount, year by year, for many years of the future, if the company furnishes facilities for reaching the mineral deposits near its lines.

The cotton trade is and must continue to be the most important of its traffic items. In 1860–61 it carried 17,728 bales of cotton to Norfolk,—in the cotton-year 1880–81 it carried 293.334 bales, averaging 475 lbs each, to that city. The growth of this trade by this railway has been like that of Norfolk in this great staple; in 1865–6 that city exported to Europe only 733 bales; in 1880–81 it exported 325,012 bales, weighing 154,397,686 pounds and valued at $17,112,620, as we learn from the Norfolk *Virginian*. All its receipts of cotton in 1865–6 were 59,096 bales; in 1880–81 they were 702,915, a gain of 128,246 over those of 1879 80. Now the third cotton-port of the country, and bidding fair to soon become the second, mainly through the agency of its railways, Norfolk has the best of prospects, chiefly by the aid of the same agencies, for soon becoming, in other things as well as in cotton, one of the great commercial cities of the Atlantic seaboard. The cotton trade properly conducted can be made to bring with it all other kinds of trade, especially when its highways to market are by a connected system of railways, like those so forcibly shown in colors on the accompanying map, that reach and ramify into the most wealthy portions of the Union where the articles of return-trade, that can be carried by the same highways, are so much in demand. Hence the importance of such connected and far-reaching systems of railways for building up commercial cities within our borders where all the conditions for their existence are so highly favorable.

In this connection, with the map so conveniently at hand for reference, it is well to call attention to the advantages which the Norfolk and Western railroad has through its associated lines, the Louisville and Nashville, and the East Tennessee, Virginia and Georgia systems of railways, for reaching the cotton crop where the larger portion of it is grown. The cotton crop of 1880, over six million bales, was double that reported in the census of 1870, but the two crops probably came in the main from the same states. Of the 3.011,996 bales produced in 1869 (census of 1870), these seven states, Tennessee, Georgia, Alabama, Mississippi, Louisiana, Arkansas and Texas, produced 2,599,624, or over five-sixths of the whole. The cotton-map of the same census locates the most productive cotton area as being that on each side of the Mississippi, roughly from the Washita on the west to the Yazoo on the east, and between the parallel of Memphis and that of the mouth of Red river. In fact at the recent meeting of the Cotton Planters' Association its president stated that "the little strip of land in Mississippi lying between the hills and the Mississippi river, from the Tennessee line to Vicksburg, and known as the Yazoo delta, is alone capable of producing 5-million bales."—The map shows that all the states above named are, so to speak, within the grasp of the railways in question.

The following table, compiled for us by Col. Portlock from the books of the company, shows the cotton-movement over the Norfolk & Western for the past year, by months and by states whence it came.

Statement of Bales of Cotton brought to Norfolk, Va., by Norfolk & Western RR, and from what States, by months, during the cotton year, September–June, 1880–81:

(1880)	Ala.,	Miss.,	Geo.,	S. C.,	N. C.,	Va.,	Ark & Tenn.	Totals.
Sept.	4,379	505	4,149	3,452	3,517	85	726	16,813
Oct.	10,014	866	11,329	2,235	5,848	3,573	9,511	43,386
Nov	13,737	2,091	12,286	2,125	5,133	1,279	19,805	56,456
Dec.	15,543	2,097	6,914	2,779	3,870	284	22,105	53,592
(1881)								
Jan.	9,500	2,032	7,524	589	1,064	102	12,799	33,610
Feb.	6,183	2,284	2,911	620	732	309	8,974	22,013
Mar.	5,965	1,444	2,941	653	783	207	12,155	24,148
Apr.	5,935	1,268	2,226	374	293	65	10,731	20,892
May	4,940	714	605	570	328	10	5,662	12,829
June	2,332	861	45	371	130	13	4,063	7,815
Totals	78,538	14,162	50,930	13,768	21,698	5,927	106.531	291,554

In its *relation to other lines of transportation* the Norfolk & Western forms a part of the "Virginia & Tennessee Air-Line," a combination of railway and steamship lines that connects Boston,

(*Continued from page* 87.)

cent of iron and 0.02 per cent of phosphorus. Another vein, two miles long, averaged 50.49 per cent of iron and 0.117 of phosphorus. Washed fine ore held 50.36 per cent of iron and 0.18 per cent of phosphorus before that process.

Prof. Frazer had also made some analyses to determine in what way weathering would affect these ores. Selecting samples, he found that fresh ore held 52.82 per cent of iron and 0.08 phosphorus, while ore which had been weathered on an old face opened 1½ years ago, contained 54.35 per cent of iron and 0.11 per cent of phosphorus. He gave a series of analyses of ores from Lake Superior mines, with the purpose of showing that the average of them was not as good as those from the Riverville and the other districts of the section spoken of. He stated that in his opinion they might be profitably worked, notwithstanding the fact that they were found only in thin veins.

During the talk which followed this paper, Mr. Hotchkiss left the beaten tracks of scientific discussion and delivered a brief, but clear and eloquent, description of Stonewall Jackson's campaign in the Shenandoah Valley, which was received with much applause. At its close the members attended a reception at the hall of the Deaf, Dumb and Blind Institution of Virginia. Many of the ladies and gentlemen of Staunton and vicinity had gathered, and the efforts of the local committee in bringing about a fusion of the two parties—guests and hosts—were completely successful.

After a promenade concert an adjoining hall was thrown open and the company was invited to partake of an excellent collation, which was beautifully arranged, the tables being decorated with a profusion of flowers, which, it was confidentially stated, had been contributed and placed by the ladies of Staunton. The guests were then conducted to the grounds surrounding the institution, which had been brilliantly illuminated, and there witnessed a fine display of fireworks. It was after midnight before the last stragglers left.

On Wednesday morning a special train carried the party over the Shenandoah Valley Railroad to the Shenandoah Iron Works, where a short stop was made to visit the forge. The latter has seven fires and one 6-tuyere run-out, in which the warm-blast pig coming from the furnace belonging to the company is refined and converted into blooms. The forge has one Ferris & Miles hammer and a rather primitive blowing engine, built by B. F. Pomroy & Son, Pottsville, Pa., having one steam cylinder and two horizontal blowing cylinders, provided each with one flap valve at each end. The product is given at 1,800 tons per annum. Unfortunately, there was no opportunity to visit the extensive iron deposits and the furnace of the company, the prospect of a visit to Luray Cave having too great an attraction for all but a very small number. The projected trip to the mines was therefore abandoned, and the whole party proceeded to Luray Station, where a lunch was first partaken of. Then a short ride or walk brought the members to the famous Luray Cave, now the property of the railroad company, who are building a large hotel near the depot to accommodate visitors. For hours the members rambled about the commodious halls and chambers of the cave, whose fantastic and imposing stalactites and stalagmites were lighted by about 4,000 candles.

The fact that the cave is dry throughout, admirably ventilated and well fitted out in other respects for the convenience of visitors will make it all the more popular. Its dimensions and the beauty and grandeur of its formation baffle description, and, though the party remained for hours, it appears to have been so attractive to a few of the members that when they reached the station they found that the train had left. On its return to Staunton the party had time enough to prepare to go to witness an amateur performance of the Pirates of Penzance, for the benefit of a fund for the erection of a statue to Stonewall Jackson. The ladies and a few of the gentlemen performed their parts very creditably, and were given an enthusiastic reception by the audience, fully two-thirds of which were members of the Institute, their ladies and friends. The bombardment of the heroine with bouquets by a few members was accomplished with much vigor and precision, and brought down the house at once. Between the first and second acts, Mr. R. W. Raymond was introduced, and in felicitous and witty speech conveyed to the citizens, and especially to the ladies of Staunton, the warm thanks of the Institute for their cordial reception of the members.

On Thursday a special train left Staunton by the Chesapeake and Ohio Railroad for a visit to a number of furnaces and mines along that road. The first point of interest touched was Ferrol, where the Grace Furnace, belonging to the Pennsylvania and Virginia Iron and Coal Company, of which Mr. J. F. Lewis is general manager, is located. The Grace is a coke stack 45 feet high, with a 10-foot bosh, making from Ferrol and Clifton Forge ores from 15 to 17 tons of forge iron per day for Western markets. It has a 20 by 48 Weimer blowing engine, the blast being heated to 800 degrees in iron hot-blast ovens. The stock, iron ore and limestone, are run direct from bins into the tunnel head, while the coke is hoisted from the level of the railway by an incline.

After a short stay at the Grace Furnace, the train proceeded to the junction of the Chesapeake and Ohio Railway and the narrow-gauge road leading to the mines and furnaces of the Longdale Iron Company, Messrs. Firmstone, Pardee & Co. The road, which follows a picturesque valley, is seven miles to the furnaces, which are 230 feet above the track of the Chesapeake and Ohio Railway. Passing by the furnaces the party made the additional 4½ miles to the mines, which are located 560 feet above the furnaces. The Longdale iron ore deposits belong to a belt traced for a long distance. Their thickness ranges from 5 to 20 feet, the measures being considerably disturbed. After an inspection of the mines the cars were taken and the party returned to the furnaces, where only a brief stay, too short to do justice to the plant, was made. Although at first sight it may appear strange to find the furnaces of the Longdale Company located so far from the main road, the development of the enterprise and some important considerations justify the choice of the site. The plant is very substantial and well arranged, and on every hand there are evidences of careful and conscientious management. There are two coke stacks on the site of an old charcoal furnace, one of which is 60 by 14 feet, while the other is 60 feet high and has an 11-foot bosh. Both make forge iron, the capacity being about 450 tons per week, from ores averaging 46 per cent of iron in the furnace and carrying 0.5 per cent of phosphorus. The stock is hoisted up to the tunnel head by an incline run by water engines. The power for the latter is furnished by a flume 4,300 feet long, which delivers the water to the engines with a head of 60 feet. The furnaces are blown with Weimer engines, having a diameter of blowing cylinder of 5 feet and a 4-foot stroke. The blast is heated in U-pipes to about 800 degrees. The coke is obtained from the company's own ovens at Sewell, on the New River, and it is stated that at one time from 18 to 20 cwts. of coke were used for making 1 ton of iron. With a grade of coke not quite so good, the present consumption is 22 cwts. The limestone is found in abundance and of good quality, in close proximity to the furnaces. The men employed are almost exclusively colored, and it is stated that in every respect they are satisfactory workmen, which is confirmed by the managers of other furnaces in the vicinity.

Returning by the narrow-gauge of the Longdale Iron Company, the members were carried to Low Moor, where an elegant lunch awaited them. A visit was then made to the mines of the Low Moor Iron Company. The furnace plant of the Low Moor Company is modern, and is built for fast driving. We were unable to obtain details, but it was stated that the three small Whitwell stoves used for heating the blast, were not sufficient to carry the temperatpre of the large volume of blast forced into the furnace above about 800 degrees. Judging from appearances, the furnace did not appear to be in the best condition for doing a large amount of work.

Again taking the train, the Institute proceeded to White Sulphur Springs, where a trying delay in securing accomodation for the unexpectedly large number of guests occurred. In the evening the final session was to take place in the ball-room of the White Sulphur Springs Hotel. By the request of many members, Major J. Hotchkiss, of Staunton, repeated a lecture on the Shenandoah Valley campaign, an outline of which had already been given by him.

Owing to the lateness of the hour and the fatigue of the members after the excursions of the day, it was thought best to read the remaining papers by title. The following are the titles of the papers thus read:

The Hydro-metallurgy of Copper and Its Separation from the Precious Metals, by Dr. T. Sterry Hunt, Montreal, Canada.

Leaving the New River, after a rapid descent from the Hawk's Nest mine, the party entered the valley of the Kanawha river. Passing down the latter, a good opportunity was offered to view the splendid scenery, but no time was left to examine any of the mines along the route, and after reaching Coalburg the train returned to White Sulphur Springs, which was reached at such a late hour that the idea of holding a formal dinner, which has become one of the features of the Institute meetings, was abandoned.

On Saturday morning the members were taken by a special train into the James River valley by the Richmond and Alleghany Railroad, which is now being built partly along the banks of the old James River Canal, the locks of which are still visible along the route. The members were shown the arch at Clifton Forge, from which the specular ores supplying some of the furnaces are taken. No stoppage, however, was made until Gilmore's Mill station was reached, where the party left the train, and by a few minutes' walk reached the Natural Bridge, which is now made so easily accessible since the construction of the Richmond and Alleghany Railroad. The gorge, spanned with its lofty arch 40 feet thick, 215 feet above the the level of Cedar Creek, was for hours filled with the engineers and their ladies, who were eagerly seeking new points from which to admire nature's wonder; and with appetites whetted by good exercise, full justice was done to the dinner spread at the inn near the bridge. A number of gentlemen, among them Secretary James G. Blaine, Wm. H. Barnum and Gov. Cornell, have joined to purchase for $20,000 the tract on which the Natural Bridge stands, and intend making a public park of 600 acres and building a large hotel, to be completed at an early date. During the stay at the bridge, Mr. H. C. Parsons, vice-president of the Richmond and Alleghany Railroad, made a very interesting speech on the advantages and aims of the new railroad enterprise.

Returning to the station, with a farewell to those who were leaving the party to go by packet direct to Lynchburg, the company started on their homeward trip, and, reduced in number, reached Williamson, whence about one-half returned to White Sulphur Springs to spend the Sunday in comfort, while the rest resumed their journey at a later hour.

Thus ended the Virginia meeting, the remembrance of which will long be cherished by those who attended it. The graceful hospitality of the Virginians, the earnest and unceasing endeavors of the gentlemen of the local committee, and the generous assistance of the managers of the Shenandoah Valley, Chesapeake and Ohio, and Richmond and Alleghany railroads, who together carried the party 700 miles, contributed to make the meeting most successful and enjoyable."

The Metal and Mineral Traffic of the Norfolk & Western RR. (formerly Atlantic, Miss. & Ohio) for April and May, 1881, based on data kindly furnished for the THE VIRGINIAS by Col. E. E. Protlock, auditor of the road, in 2,000 lbs. tons, was as follows:—The traffic for the 1st quarter of 1881 was published on page 67 of May No.

1. VIRGINIA METALS AND MINERALS TRANSPORTED.

Pig iron, 1,813 tons carried; 837 in April, 976 in May. It was shipped from Rural Retreat, Crocketts, Max Meadows, Martins, Dublin, Christiansburg and Lynchburg. (See table of accompanying map for location.) Its destinations were, 302 tons to Baltimore, 587 to Philadelphia, 18 to Petersburg, 639 to Richmond, 61 to R. & D. RR., 11 to Va. Mid. RR., 195 to Southern States.—The quantity transported was about 7 per cent more than in the preceding 2 months. A noticeable and gratifying feature, as in our previous report, is the continued increase in shipments to Richmond, Va., to meet requirements of that market; 50 per cent more having gone there in April and May than in Jan., Feb. and March. The steady increase in shipments to Southern States is also a significant fact. This time Philadelphia, and not New York, received the largest portion of shipments northward.

Iron ore, 1,654 tons carried, 889 in April, 765 in May. It was shipped from Ironville, in Bedford county, from mines in Potsdam of Western Blue Ridge, and from Cochenour, in Campbell county, from old Oxford furnace mines in Midland-Piedmont belt of the Archæan. Its destination was, 11 tons to Norfolk, in April (probably a car-load for trial by some Northern furnace), and the remainder, 1,643 tons, to Lynchburg, for use in furnace there.

Zinc spelter, 35 tons carried, all from Bertha Zinc Works at Martins, 23 tons in April, 12 in May. New York received 24 tons, and Baltimore 11.

Zinc ore, 13 tons carried in May to a way station, origin not stated,—probably a sample car-load to Bertha for testing.

Pig lead, (including pig, bar and shot), 15 tons carried, 13 in April and 2 in May, from Max Meadows and Wytheville. Boston received 11 tons and 4 went south.

Barytes, 780 tons were transported, 325 in April, 46[illegible] May, from Marion, Wytheville, and Lynchburg. Bost[illegible] ceived 5 tons, New York 442, Baltimore 1, Philadelp[illegible] Richmond 3, and Southern States 36.—The trade in [illegible] eral increases very steadily.

Limestone, 876 tons were taken, 610 in Apr[illegible] May, from Ironville,—quarried from formati[illegible] Cambrian, there exposed adjacent to the ir[illegible] worked. Its destination was Lynchburg [illegible] furnace there.

Marble, 3 tons, 2 in April and 1 in M[illegible] station," appears for the first time a[illegible] ported. It was from Wytheville wh[illegible] of beautiful colored, or fancy marb[illegible]

Manganese, 236 tons, in May, was from Cochenour's siding 6[illegible]

Plaster, 1,680 tons, 1,280 i[illegible] transported from Saltville, S[illegible] & D. RR. received 15 to[illegible] States 677.

Salt, 611 tons were s[illegible] May; 154 to way stati[illegible]

Coal, from Mart[illegible] transported, 332 in [illegible] burg, and 639 to [illegible]

The total mov[illegible] tons,—16 to Bo[illegible] to Philadelphia [illegible] Lynchburg, 6[illegible] RR., 11 to V[illegible] 1,369 to So[illegible] small a po[illegible] tons of ir[illegible] of that t[illegible] data fur[illegible]

2.

Fro[illegible] receiv[illegible] kinds [illegible] in M[illegible] 522 [illegible] 132 [illegible] 48 t[illegible]

F[illegible] Ma[illegible] tak[illegible]

T[illegible] and [illegible] ical [illegible] gy [illegible] cou[illegible] and [illegible] lea[illegible] fav[illegible] stan[illegible] our [illegible]

M[illegible] Salt[illegible] mig[illegible] whi[illegible] the [illegible] the[illegible] non[illegible] yet, [illegible]

the Proceedings), which flows alongside this plain, its waters communicating with the salt wells, as Prof. Lesley showed some years ago.

Mr. L. found the shells on the banks of the Holston the same as those in the plain. In a number of pits he had dug he found the surface stratum, 3 ft. deep, to be a layer of these shells, most of them *unios*, etc., broken, but the gasteropods whole, mixed with pottery and embers,—evidently a *kitchen-trash deposit*. The shells did not extend beyond the pottery area. The Indians broke up the univalves to mix with the pottery clay; the gasteropods must have been used only for culinary purposes.

Local drift clay, says Mr. Lewis, several feet thick, was found under the shells and pottery layer, this clay resting on the red *gypsum-salt muds*, here several hundred feet deep and occupying a basin a mile wide, eroded along an anticlinal arch of Lower Silurian limestones, the outcrops of which form the hill walls of the little enclosed secluded valley. The rocks dip 20° to 30° S. E., and from 50° to 60° N. W. towards the Holston, outside of the enclosure. This erosion must have commenced when the Apalachian continent, crowned by Permian deposits, rose from the sea on the first construction of the anticlinal and synclinal folds. The salt clays then are probably of Trias age. That the gypsum is the result of the decomposition of the limestone layers is plainly shown in the shaft and tunnel workings; and it is confined to the walls of the basin, against which the horizontal salt-muds lie non-conformably.

Prof. Lesley took this occasion (Oct. 15, 1880) to make some remarks in opposition to Prof. Stevenson's conclusions (in Notes on S. Va., p. 88, No. 107 of Proc. Am. Phil. Soc.) respecting the comparatively recent date of the *great Virginia faults*. Prof. S. says: "It seems not wholly improbable that the faults are of later date than the disturbance which produced the comparatively gentle synclinal between Wallen ridge and Clinch river;" the whole tone of his concluding paragraphs leaving the impression that he assigns the Apalachian flexing to one age and the faults to another and later age, in accordance with his opinions respecting Pa. anticlinals as preceding some coal deposits, as published in K Vols. of Second Geol. Survey of Pa.

Prof. Lesley said his long study of U. S. Coal Measures led him to doubt this coeclusion. He had repeatedly assigned the regular outspread and remarkably regular increase in the thickness of the *Pittsburg coal bed* towards the east, over the large interval of country between its Ohio outcrops and its Md. and E. Pa. outcrops, as sufficient evidence that the Apalachian folds had no existence wl atever up to the close of the Coal era.—His extensive study of the Va. and Tenn. faults, with that of the Pa. unbroken anticlinals, had compelled him to see in them one single cause producing essentially the same effect in one and the same age.

Prof. Stevenson postulates his conclusions on two classes of observations in S. W. Va.—(1) "That the course of the streams has not been determined by the lines of fault." (2) "That erosion along the faulted lines is essentially the same in character and extent with that in localities where no faults exist."

Prof. Lesley considered the 2nd postulate as essentially true, but held it as a proof of the community of the faults with the other structural features.—The 1st postulate he was obliged to reject. The topography, as illustrated by the maps and sections of his papers on the Coal-field of S. Va. in Montgomery Co., and on Scott, Wise and Tazewell counties, Va., (Proc. Am. Phil. Soc. Vol. IX p. 30, May, 1862, and Vol. XII p. 489, April, 1871,) tell nothing more plainly than that the erosion of Clinch and other Southern rivers, is wholly and entirely and in detail, most curiously determined by the faults in the absence of which the whole water-tree of that section of Va., and of all E. Tenn., would have been of a different character,—in other other words, would have imitated the water-trees of Middle Pa., where such faults are unknown. He regretted that Prof. S. was not present to explain and enforce his own views in opposition to his. (Vol. XIX p. 155.)

The Saltville fault was the subject of some notes from Prof. W. M. Fontaine, of the University of Va., communicated, April 1, 1881, to the Am. Phil. Soc. (Vol. XIX p. 349).—Prof. F. points out that the little salt and gypsum bearing valley of Saltville cannot be "eroded along an anticlinal of Lower Silurian limestone," because the southeast wall hills only are of that age, while the northwest wall hills are of Umbral (Mauch Chunk, Subcarboniferous) age. He was the first to find in the limestones on that side of the valley an abundance of Umbral fossils, in the highly fossiliferous shale beds intercalated between the massive limestones. The species are the same found in the Umbral near Lewisburg, W. Va. The Magnesian (Lower Silurian) limestone strata, bounding the valley on the S. E., show no trace of fossils.

The physical aspects of the two formations also differ. Beds of shale and limestone alternate in the hills N. W. of the valleys; and some of the limestone is cherty, and some of the shales are red. But the S. E. hills contain only solid limestone strata. Those on the N. W. side have a more rounded topography.

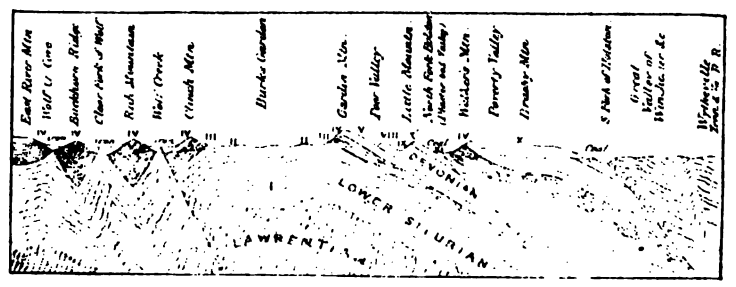
It is, however, quite true that the stratification is in opposite S. E. and N. W. directions; gentle to the S. E. and much steeper to the N. W. The structure is therefore anticlinal. But there must be a considerable fault along the axis of the anclinal, and this fault must run along the S. E. edge of the little valley.—The explanation is then simple. The Umbral limestone ridge is a synclinal; and the red-shale formation comes up on both sides of it,—with N. W. dips in the little valley,—and with S. E. dips in the valley of the Holston river, at the foot of the mountain, as shown above.

A reference to the place of the Michigan salt group in the Palæozoic series makes the presence of salt here easily understood. The horizon seems to be salt-bearing in other places in S. Va. There is a salt ooze near Max Meadows (Wythe Co.) at about this geological horizon.

Secretary Lesley suggested that the underlying Vespertine (Pocono) sandstone is a great salt-producing formation in the Ohio river up-country. That the gypsum is an acid reaction upon the eroded outcrops of the limestone, as he had shown in paper before referred to (Proc. A. P. S. Vol. IX p. 34).

We may remark, in reference to the above, that the section of Prof. Fontaine differs from the following by Prof. Lesley (referred to above, and published in his paper on Scott, Wise and Tazewell, which we published in July, 1880, but reproduce here to bring the question more fully before our readers) in that he puts the trough of the Holston (wrongly spelled Holsten in cut) in the red-shales of XI (Umbral) to the N. W. of a synclinal ridge of Greenbrier shales and limestone (XI), not *at the fault*, as Lesley does, where III and XI meet.

CONTINUATION OF SECTION No. 6 (OF THE MAP) SOUTHWARD.



A reference to Rogers' geological map (See THE VIRGINIAS for June, 1880,) will show that in 1842 Prof. Rogers had geologically mapped this region much as Prof. Fontaine states it above. On his map the Greenbrier limestone (Carboniferous Limestone Group), No. XI, is colored as joining the Valley Limestone Group (Lower Silurian, Cambrian), Nos. II and III, just east of Saltville,—but he locates the North Fork of Holston as meandering along the junction of X (Vespertine) and XI (Umbral), although at Saltville it runs in the Umbral, as Fontaine's section has it. In reference to the topography as resulting from the geology we are disposed to concur in Lesley's view.

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We have from under their hands written statements verifying all and much more than all we have here said, from such acknowledged authorities in medicine as Drs. Cabell and Davis, University of Va.; J. Gaillard Thomas and Thos. Aldis Emmet, New York; Stone and Cartwright, New Orleans The last named having broken in health and lost his hearing by his exposure and labors in Natchez in the first invasion of Asiatic Cholera in this country, spent two years abroad in visiting and studying the most noted spas of Europe. On his return to this country he spent his first summer at the Rockbridge Alum Springs, and ever after as long as he lived he continued to send his patients of the Southern country to these Springs and to order or prescribe the water for them. In a letter addressed by him to the former proprietor, Mr. Wm. Frazier, bearing date "New Orleans, July 28, 1855," after an elaborate comparison of this water, both in its constituent elements and its observed effects, with nearly all the most celebrated mineral waters of Europe, he concluded in these words: "In truth I know of no waters in Europe or America so rich in medical substances as that of your Rockbridge Springs."

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WEDNESDAY, THE 10TH DAY OF AUGUST, 1881,

that VALUABLE MINERAL PROPERTY known as the ARCADIA IRON WORKS, including the SKIDMORE PLACE, formerly the property of Wm. W. Boyd, dec'd, and recently sold by me to Richard N. Pool, who assigned his purchase thereof to L. F. Beckwith, trustee.

This property is situated on the lines of the Richmond and Alleghany and Shenandoah Valley railroads, in Botetourt and Bedford counties, beginning near Buchanan and extending down James River about ten miles, covering about thirty-nine square miles, (the foot-hills and western slope of the Blue Ridge mountain,) and embracing about twenty thousand acres in fee simple and about four thousand acres additional of mineral rights.

Part of the land is valuable for cultivation. There are on it great bodies of fine timber suitable for charcoal, mine-timbers, ties, tan-bark, &c.

Its deposits of Iron-ore—Red Hematite (Specular), Brown Hematite (Limonite) and Magnetic—are very extensive and valuable. Some 20,000 tons of the Red Hematite ore may now be seen on the dumps at the different mines. There are also on the property Limestone, Slate, Manganese, and indications of Zinc.

The Hot blast Charcoal Furnace and out-buildings are in a good state of preservation. The water-power (Jennings creek) is ample for large operations. The property may be advantageously divided into three parts.

The sale will be with a reservation of the right of way through the property, granted by R. N. Pool to the Shenandoah Valley Railroad Company, subject, however, to confirmation by the Circuit Court of Botetourt county.

TERMS OF SALE:—Cash in hand $39,000.00; as to $38,042.22 on a credit until October 4th, 1881; as to $38,042.22 on a credit until April 4th, 1882, and as to the residue, on a credit until April 4th, 1883, or at such other time on or after April 4th, 1882, as R. N. Pool, or L. F. Beckwith assignee and trustee for R. N. Pool, or either of them, may direct. For deferred payments bonds will be required, and the title will be retained until full payment.

Expectant purchasers are invited to inspect the property. For full description, analyses of ores, maps, &c., address the undersigned, or Walter N. Johnston, Esq., Buchanan, Botetourt county, Va.

JOHN W. JOHNSTON,
Buchanan, Va., June 25, 1881. Spl. Com'r

THE PAINT CREEK MINING Properties of Kanawha County, West Virginia.

PAINT CREEK MINING CO., (On west side of Paint Creek.) **10,000 acres.**

WACOMAH MINING CO., (Adjoining the lands of other Co., but mainly on the east of Paint Creek.) **4,700 acres.**

PAINT CREEK RAILROAD CO. (From mouth of Paint Creek up the same.)

All under one management with same directors and same stockholders holding same ratio of interest in each company.

L. L. CONRAD, of Baltimore, ... President.
GEORGE W. RIGGS, of Washington, ... Treasurer.

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Geo. W. Riggs, of Washington.
H. H. Parker, of New York.
John S. Barbour, of Alexandria, Pres't Va. Midland RR.
James F. Patton, of Union, Monroe Co., W. Va.
Wm H. Edwards, of Coalburg, Kanawha Co., W. Va., Pres't of Kanawha and Ohio Coal Co.
Isaac N. Smith, Charleston, Kanawha Co., W. Va.

Isaac N. Smith, of Charleston, Kan. Co., W. Va., ...Solicitor.
Oscar A. Veazey, of Paint Creek, Kan. Co., W. Va.,..Engineer

These companies have been organized for the development of valuable coal loads owned by them. They are now constructing a first-class railway through the properties, having its terminus in the pool above Lock and Dam No 3, part of the improvements now being constructed by the U. S. Government on the Kanawha River. This railway will be completed and equipped for transportation of coal in September, 1881. It crosses the C & O. Ry. and connects with it, so that shippers will have every facility for both river and railway trade.

The companies are prepared to make leases to reliable parties and to ship the coal of their lessees to river and rail upon most favorable terms.

Their Cannel, Splint, Bituminous and Coking Coals are unexcelled in quality, quantity and size of workable seams—the principal splint coal seam averaging ten feet.

Application for leases may be made to the President direct or through any of the Directors.

More particular information given upon request, by mail or otherwise, to L. L. Conrad, President, 15 Lexington street Baltimore, or Isaac N. Smith, Charleston, Kanawha county, W. Va., Solicitor of the Companies.

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We offer the fee simple in the MINERAL RIGHTS on 750 acres of land, immediately on the James River Canal and the Richmond & Alleghany RR. This property is situated a short distance below Riverville, in the heart of the magnetic and specular ore belt of the James River Valley. It is one of the most valuable iron ore properties now on the market—the deposits being very large, and the ore of the purest quality. Price $16,000.

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Attorneys,—Virginia.

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SHEFFEY & BUMGARDNER,

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THOMAS D. RANSON,

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Attorneys at Law,
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The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 7. } Staunton, Virginia, July, 1881. { Price 25 Cents.

The Virginias,

PUBLISHED MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor

At 346 E. Main St., Staunton, Va.

Terms. Including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising. per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

Entered at Staunton, Va., Post-office, as second-class matter.

Erratum—On page 107, in the P. S., XI should be 3,700 ft. thick, and not 3,800.

Rogers' Va. Geological Reports.—Persons having copies of these reports for 1836, 1837, 1838, 1839 or 1840, that they will sell at a fair price, can find a purchaser by addressing Jed. Hotchkiss, Staunton, Va.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors,), complete, with index and title page, will be sent, prepaid, to any address in the U. S., *on receipt of Three Dollars.*

Roanoke is now the official name of the station on the Norfolk & Western RR., 257 miles W. from Norfolk, that has heretofore been known as Big Lick, as we are advised by circular of July 23rd, from Vice-Pres. and Gen. Manager Henry Fink. This is the point of junction of the Shenandoah Valley and N. & W. railways.—The writer of this urged the adoption of this name because of its appropriateness, as the point where Roanoke river is first reached in going westward, thus localizing it, and because the name was not in use for railway station or post-office in Va., when it was decided to make there the S. V. RR. junction, and he first introduced it on the geological map which accompanied his letter of March 12, 1881, (published at that time) to Pres. Kimball on the "Mineral Deposits along the S. V. RR."

Copper.—John C. Karsten, M. E., writes us that he is mining copper, near Linden, Warren Co., Va., on Manassas branch of Va. Midland RR. The vein worked is mostly *native copper*, in a hard, slaty formation that in places becomes a quartzite. The ore varies in purity from 10 to 72 per cent. There are three veins in that locality; one is a *red oxide*, the other *black copper*. Very little or no *gray copper* (Tetrahedite) is found, and no *peacock* or Ore-Knob copper. The ore mined here is cobbled and barreled and sent to Baltimore.

The paper by Dr. Egleston on the "*Ore-Knob Copper Process*," a part of which, from an advance copy kindly sent us by its author, we publish in this issue, applies to the copper ores of the Blue Ridge plateau in Va. as well as it does to the ores of N. C.—Its carefully prepared details of the composition of ores, and the cost of mining, labor, charcoal, provisions etc., furnish most valuable and reliable information for all that would engage in mining and smelting operations in S. W. Virginia.

The Baltimore Sun is entitled to the fullest measure of thanks from everyone interested in the development of the Virginias for the full and everyway satifactory reports it gave, for a full week, of the proceedings of the American Institute of Mining Engineers, during its recent Virginia meeting, and especially for the large amount of information it furnished—not only for its own wide circle of readers, but also, as any reader of exchanges could see, for the press of the whole country—concerning the resources and industries of the portions of these states visited by the Institute. Its special correspondent, Mr. N.E. Foard, must have credit for these letters; the editorials that appeared with these letters and emphasized their salient points, were first rate,—in fact, *The Sun* did its duty to the Virginias on that occasion, as Mr. Foard said it meant to. We wish as much could be said of the daily press of the Virginias, which, with the honorable exception of the *Lynchburg Virginian*, did not have a representative in attendance during the week-long meeting, extending through 700 miles of their territory, of a body of men that does and can do more than perhaps any other to promote their development. We are ashamed of them for their stupidity; the only sense they gave evidence of was the copying of *The Sun's* letters and editorials.

The Virginia Military Institute, now in the 43rd year of its existence, is Virginia's "*school of general and applied science*," one that from its inception has had the fostering care of the state, now thrown open—with all the accumulated wealth of its experience in advanced educational training, and of the fame of those that have been educated by it—to all that would become skilled in the art military, or as civil or mining engineers, chemists, geologists, or as trained directors of industrial operations.

In sending us the notice that appears in our advertising columns, Gen. Smith, the distinguished Superintendent of this Institute, calls our attention to the fact that 8 or 10 of its graduates are now actively engaged, as mining engineers, in Colorado, where they are doing good work (as Virginia boys always do when brought into competition with others, we may add) and acquiring reputation.—Among these are two Witherses, located at Kokomo, A. A. Blow and W. B. Page (the latter having won great distinction in a contest concerning the title to some mineral lands which depended on geological questions which were solved by his skill) at Leadville, M. R. Miller and C. L. Beckwith, at Denver, etc.

As we stated in our previous issue, there is a very great demand for engineers of all kinds, and we are glad to commend to our young men the schools that educate for that profession.

Steatite, or soapstone as it is commonly called, it is reported in *The Dispatch*, is abundant in Amelia county, Va., about midway between the Court-house and Chula station. The bed is said to have been proven as underlying some two acres at a depth of 10 or 12 feet. The Indians formerly worked this quarry for material for pots for cooking purposes, as it stands fire well. The owners intend to develop this quarry and furnish this material as a substitute for fire-bricks in grates of all kinds, etc. It is quite soft and can be sawed into almost any shape.

The article quoted says steatite is a rare mineral. In this it is mistaken; it is found in many places in Virginia. We recall, for example, the fine quarries of it in Henry county, near Spencer's Store, whence blocks of almost any required dimensions, for the foundations of houses and other purposes, are sawn out and then finished by planing. We bring a considerable quantity of soapstone for fire.places, grate-backs, etc., from other States; we ought to use it more largely, not only for such purposes, but also in blrst-furnace construction, obtained from Virginia quarries, and also make the superior stone that is here found an article of export.

"*The Coal Trade, a Compendium of Valuable Information relative to Coal Production, Prices, Transportation, etc., etc.; at home and abroad, with many Facts Worthy of Preservation for Future Reference*"—is the full title of the volume that Frederick E. Saward, Editor of "The Coal Trade Journal," issues annually. The author has favored us with the edition for 1881; we find it replete with full and accurate information concerning the subject of which it treats, and an extremely valuable work for reference.—Price 50 cents. Address The Coal Trade Journal, 111 Broadway, New York.

"*The Coal Mines of Pennsylvania*"—is the title of a handsomely prepared pocket volume on the Anthracite and Bituminous Coal Mines of the leading Saate of the Union in the production of coal; by Frederick E. Saward, Editor of "The Coal Trade Journal" of New York. This work contains a list of all the coal mines of Pa., their location and the names of the operators; it is illustrated by three maps. It is a very valuable guide for any one having aught to do with the coal mines of Pennsylvania, and we might say who has not? It is richly worth the $1 that is asked for it.

Our August number will contain the completion of the editorial on the Norfolk & Western and Shenandoah Valley railways. We have spent so much of the month in the Craig Creek iron-ore field and the Great Flat-Top coal-field making explorations to meet the constant demands for information during the rapid development now going on, and have not been able to complete that article, as we had intended, in this number.

A full paper on the Great Flat-Top Coal Field, one of the most remarkable and promising we have ever examined, will also appear in our next issue.

Notes on the Geology of West Virginia.

By Jno. J. Stevenson,

Professor of Geology in the University of New York.

(*Continued from page 75.*)

Lower Barren Group.—It will be remembered that in the section given in my former paper, eight strata of limestone, having in all a maximum thickness of 30 feet, were represented as belonging to this group. These disappear southwardly, so that at Clarksburg only two remain, one underlying the *Pittsburg* coal, and the other about 100 feet below it. Still farther south, in Lewis county, we find that only the upper one holds out, and that disappears long before reaching the Great Kanawha river. Even the fossiliferous limestone, which, in the Ohio Reports, I have named the *Crinoidal Limestone*, thins out finally before reaching the Northwestern Branch of the Baltimore and Ohio railroad, though it is persistent in Ohio, Pennsylvania and Northern West Virginia. The fossiliferous shales accompanying this limestone were traced to near Pruntytown, in Taylor county, beyond which, southward, they were not seen. Not far from Pruntytown they yield beautiful specimens of *Productus prattenianus*, *Nucula ventricosa*, *Nucula*, (?) *anodontoidas*, *Yoldia carbonaria*, *Yoldia stevensoni*, *Edmondia aspenwalensis*, *Pleurotomaria* (?) *tumida* and *Bellerophon meekianus*.

Southward to the railroad and east from the Laurel Hill axis, the shales increase greatly, but farther toward the south and especially along the axial line they are replaced by sandstone, so that on the Staunton pike, where the whole section is fully exposed for 300 feet below the *Pittsburg* coal, the only rocks are sandstones. East from the axis the shales predominate, and for the most part are of a deep brick red color. The same color characterizes them in the disturbed region at the west.

In Upshur and Randolph counties, between Buckhannon and Beverly, the Lower Barren Group seems to contain no coal, but in the vicinity of the former village, there is a small seam about 40 ft. below the *Pittsburg*. Between Buckhannon and Clarksburg another is seen about 100 ft. below that coal, and it occurs also at the latter place.

The thickness of this group shows little variation along the eastern border, and is not far from 400 ft.

Lower Coal Group.—In Upshur and Randolph counties, it is impossible to procure a detailed section of this group without the expenditure of very much more time than was at my disposal. The whole country is deeply buried under debris, and connected exposures are rare. The rapid and somewhat irregular increase of dip near Rich mountain, and the long stretches of "concealed," along the roads and streams render the building of a section exceedingly difficult. It is, however, sufficiently evident that this group, barely 200 ft thick, near the Pennsylvania line, has rapidly developed so as to be in these counties scarcely less thick than on the Great Kanawha river, where it is nearly 900 ft. from the Conglomerate to the top of the Mahoning Sandstone. The following partial section beginning with the Mahoning Sandstone, is said to have been obtained in a salt well bored on Buckhannon river.

	ft.		ft
1. Rock	60	7. *Coal*	4
2. *Coal*	15	8. Sandstone	40
3. Shale	32	9. *Coal*	3
4. Sandstone	40	10. Sandstone	120
5. *Coal*	4		
6. Rock	160	Total	487

The boring clearly stopped far short of the base as it did not reach the large and very persistent coal bed resting on the Conglomerate. As nearly as can be determined, the thickness of the whole group is not far from 700 ft.

No. 1 of the section, the Mahoning Sandstone, is ordinarily separated from the underlying coal by from 6 to 10 ft. of shale. It is a coarse sandstone, with numerous lines of pebbles arranged parallel to the general plane of bedding. Some portions show extensive cross-bedding, and occasionally the rock is a coarse conglomerate. It is of uneven texture, and weathers into irregular cavities. Rude casts of vegetable stems are of common occurrence, and a thin coal is sometimes found about 40 ft. from the base.

No. 2 is the *Upper Freeport Coal*. Its changes in Upshur, Randolph and Barbour counties are very interesting. East from Buckhannon, on the Beverly road, it is first seen at the Sand Run crossing, in a deserted opening. The shale above it is dark, fissile, and about 7 ft. thick. Above this is the Mahoning Sandstone. The first satisfactory exposure is on Roaring creek, at the foot of Rich mountain, where the coal is worked and shows the following section:

	Ft.	In.		Ft.	In.
1. Shale, drab, argillaceous	10	—	10. *Coal*, semi-cannel	1	1
2. *Coal*	—	4	11. Clay	—	½
3. Shale, dark, argillaceous	2	4	12. *Coal*, mostly semi-cannel	3	2
4. *Coal*	—	10	13. Clay, slickensided	—	4
5. Clay, carbonaceous	—	1	14. *Coal*	1	9
6. *Coal*	—	10	15. Shale, drab	—	4
7. Clay	—	¼	16. *Coal*, poor, seen	1	11
8. *Coal*	—	9			
9. Clay	—	¼	Total		

Of this section, the portion from No. 4 to No. 14, inclusive, yields a coal, fairly good, but of very uneven quality. It is a good fuel, and carelessly examined, appears to be quite clean. Under a glass it shows many minute crystals of pyrites, and when exposed to the weather soon becomes streaked with copperas, so that its commercial value is at least doubtful. On Sand run several miles south from the crossing of the Beverly road, a remarkable expansion of the bed is exposed in the bank of the stream. The section is as follows:

	Ft.	In.		Ft.	In.
1. Bituminous shale	5	—	8. Clay, drab	—	8
2. *Coal*	—	7	9. *Coal*, bony	—	6
3. *Cannel*, poor	2	6	10. Clay	—	8
4. Shale, slightly carbona's	4	—	11. *Coal*, slaty	1	1
5. *Coal*, slaty	1	10	12. Clay, with streaks of *Coal*	1	2
6. Shale, slightly carbona's	1	3			
7. *Coal*, partly cannel	2	2	Total	21	6

In all this, the only coal which is fit for any purpose is No. 7, and even that is good for fuel in case nothing else can be had. Yet this enormous mass of bituminous shale and bad coal has aroused great expectations throughout Upshur county. Its vastness, as reported on by a voluntary committee of the Legislature, is said to have caused a number of legislators to look with favor upon Buckhannon as the site for the State Capital. The prevailing opinion respecting this bed is that its value is incalculable, whereas it is utterly worthless.

Passing over to Grassy run, another tributary to Buckhannon river, we find this bed mined on the property of Mr. G. Marple. Only a portion is exposed, giving the following section:

	Ft.	In.		Ft.	In.
1. Arenaceous shale	4	—	5. Clay parting	—	½
2. Bony *Cannel*	—	3	6. Bony *Coal*	—	6
3. Parting	—	½	7. Slate	—	11
4. *Coal*	—	11	8. Bony *Coal*	1	4

The coal from this bank is not very highly esteemed.

About a mile farther down the run, an exposure in a bluff is as follows:

	Ft.	In.		Ft.	In.
1. *Cannel*, very poor	4	—	12. *Coal*, bony	—	4
2. *Coal*, bony	1	11	13. Clay	—	6
3. Clay, slickensided	2	2	14. *Coal*	—	5
4. *Coal*, semi-cannel	—	8	15. Shale, drab	—	8
5. Shale, carbonaceous	—	3	16. *Coal*	1	6
6. Sandstone	—	3½	17. Clay, slickensided with remains of plants and streaks of coal, seen	1	—
7. *Coal*	—	4			
8. *Cannel*, poor	1	1			
9. *Coal*, slaty	—	11			
10. *Coal*, good	1	4			
11. Clay,	—	9	Total	18	1¼

A similar section occurs on Buckhannon river about 10 or 11 miles above the village of Buckhannon, but it is unnecessary to give it here. The coal is visible at many points along Roaring creek to Tygart river, and on that stream to within a few miles south from Grafton. On Roaring creek, Mr. Jabez Woolley has measured it at three exposures, where he found the thickness 8, 12, and 20 ft. respectively. Wherever it falls below 12 ft., it contains coal in sufficient bulk to be workable. Ex-Gov. Pierpoint informs me that some years ago it was proposed to mine this bed on Tygart river 7 or 8 miles above Grafton. The coal exhibited was very handsome, and to the naked eye showed no evidence of pyrites, but as soon as it was put under a glass it proved to be loaded with minute crystals of that material. It was thought unnecessary to resort to chemical analysis for further information, and the enterprise was abandoned.

Near Weston, in Lewis county, this coal is said to occur in the bed of the West Fork river, which is very probable, as the river cuts through the Laurel Hill anticlinal north from Weston. Following this anticlinal northward, we find it rapidly increasing in sharpness, so that at Valley Falls, where it is cut by Tygart river, the Great Conglomerate is in the bed of the stream, and the Mahoning Sandstone barely crosses the crest unbroken. Near this point, at Nuzum's Mills, probably 40 miles from Weston, the following section of the Lower Coal Group is obtained:

	Ft.	In.		Ft.	In.
1. Sandstone	60	—	11. *Coal*	—	6
2. *Coal*	3	—	12. Shale	15	—
3. Sandstone	30	—	13. *Coal*	0-3	—
4. Limestone	3	—	14. Fire-clay, compact	3 to 6	
5. Sandstone	30	—	15. Iron ore	2 to 6	
6. *Coal*, U. Freeport	5-6	—	16. Shale	15	—
7. Sandstone	45	—	17. Great Conglomerate	—	—
8. *Coal*	2	—			
9. Fire-clay, compact	1	—	Total		
10. Sandstone and shale	65	—			

The *Upper Freeport* here shows, *Cannel*, 1 ft.; Bituminous *Coal*, 4 to 5 ft. It is somewhat inferior owing to the presence of much sulphur, but is a good strong fuel. On Prickett creek, in the same county (Marion), the cannel is at the bottom, and in greater quantity. Extensive arrangements were made here, years ago, for distilling oil from the coal, but the discovery of petroleum brought the enterprise to a premature dissolution. On Booth creek, in Monongalia county, some old openings are still accessible. One a little way north from the creek shows:—Clay, 1 ft.; *Coal*, 1 ft. 11 in.; Clay, 8 in.; *Coal*, 2 ft. 9 in.; Clay, 2½ in.; *Coal*, 1 ft. 1 in.

A deserted opening near the old furnace on this stream gives:—*Cannel*, 1 ft.; Carbonaceous shale, 11 in.; *Coal*, slaty, 4 in.; Clay, 7 in; *Coal*, 2 in.; Clay, 4 in.; *Coal*, seen, 4 ft.

The coal at the base is certainly much thicker than is stated. The old props lying in the deserted entry are somewhat more than 5 ft. long. Another exposure near the mouth of the creek shows the bed much degraded, giving the following section:—*Coal*, 1 ft. 9 in.; Clay, 3 in.; *Coal*, 6 in.; Shale, 2 in.; *Coal*, 1 in.

The roof here is sandstone. Elsewhere upon the creek it is shale, which abounds in vegetable impressions. The coal from these openings is said to be very good fuel though it contains considerable proportion of sulphur. It contains much volative combustible matter and cokes readily in heaps.

Returning to Upshur county, we find underlying the *Upper Freeport* Coal a sandstone about 50 ft. thick, more or less flaggy, and apt to change into arenaceous shale. Below this is a thin tough limestone, not very pure, which seems to represent the Freeport Limestone. It was seen on the Staunton pike near Roaring creek and on Sand run. Between the limestone and the coal below, the sandstone is coarse and flaggy. The interval varies from 20 to 30 feet.

The next coal, No. 5, of the salt-well boring, was seen at only two localities, one on Roaring creek, near the Staunton pike, and the other on Sand run, near the great exposure of the *Upper Freeport*. It is a persistent bed and quite regular in thickness, varying little from four feet throughout this vicinity. The coal is irised, exceedingly rich in bituminous matter, and containing not a large amount of sulphur. It burns nicely and cokes well. No regular workings were found, and only "crop" coal could be examined. This is extremely brittle, so that, unless it improve greatly under the hill, it will hardly prove fit for shipping.

The beds, No. 7 and No. 9, of the boring have not been identified at any locality. Three miles east from Roaring creek, and 500 ft. higher than the opening on the *Upper Freeport*, the blossom of a coal bed occurs at the roadside. This is probably one of the lower beds, but the question cannot easily be determined, as eastward the dip increases rapidly in steepness, and the whole western slope of the mountain is so deeply buried under shingle and so thoroughly paved with fragments of sandstone and conglomerate, that connected exposures cannot be found.

East from this blossom, almost two thirds of a mile distant along the pike, and very near the crest of the ridge, a coal-bed is worked. The mouth of the mine is 300 ft. higher than the blossom in the roadside. In the interval along the road everything is concealed except occasional exposures of sandstone. The bed near the crest is dipping northwestward at 12°, so that the space between it and the coal above would be nearly 500 ft., provided the dip does not vary. It is better to regard the interval as about 400 ft The coal is within a few feet of the Conglomerate, but the intervening rock is concealed. At the opening made by Mr. S. B. Hart, near the pike, the bed exhibits the following structure:—Shale,—; *Coal*, sulphurous, 4 in.; Black clay, 1 in.; *Coal*, 3 ft. 6 in; Clay, 1 in.; *Coal*, 1 ft. 7 in.; total, 5 ft. 7 in.

The bottom coal is very inferior, being about one-half slate, and containing a notable proportion of pyrites. The bench next above it is a good fuel, though rather soft and toward the base somewhat sulphurous. It is extensively mined to supply Beverly and the adjacent country. I made as careful search for other outcrops as is possible in a wild region, covered with loose rocks and a dense forest. No other was found, unless the bed exposed at the head of Casseday fork of Buckhannon river be the same. This occurs near the crest of the ridge on the west slope about 10 miles south from the Staunton road. It is a large bed, and is most likely this coal. There is no doubt that this is the same with that found on the Conglomerate in Marion and Monongahela counties. If it be as irregular in thickness here as in northern West Virginia and Ohio, its outcrop will be traced only with great difficulty.

Aside from the *Freeport*, itself reduced to almost nothing, no limestones were seen in this group. As in the other groups, the limestones disappear southward. They occur in Pennsylvania, but thin out rapidly after coming into West Virginia.

The Great Conglomerate.

This rock forms the crest of Rich mountain for nearly 16 miles, within the region examined. For the most part it is a coarse sandstone loaded with pebbles from ⅓ of an inch to 2 inches in diameter. Along the Staunton pike it shows some layers of slightly micaceous and very compact sandstone near the bottom. Here it is greatly increased in thickness. Near the northern line of the State it is barely 350 ft. thick, but in Randolph county it is not less than 600. The expansions continue southwardly, as shown by the observations of Prof. Fontaine, in the New River region. On Rich mountain it contains no fossils, but in portions there are vast numbers of quartz crystals, some of them three-fourths of an inch long, and beautifully terminated at both extremities.

On the Staunton pike, along the eastern slope of the mountain, there was seen midway in the conglomerate, what appeared to be the blossom of a coal-bed. As I had observed no evidence of coal in the conglomerate northward from this locality, this exposure was studied with some care, but nothing definite could be ascertained Six miles farther south on the same side of the mountain, a small coal-bed occupies this place on the property of Mr. Bradley. There it is 3 ft. thick, quite soft, but of excellent quality, and being almost free from sulphur is highly prized by blacksmiths. Another opening has been made on the ridge near the bridle path, 7 miles south from the Staunton pike, and a third is seen near the same path, 3 miles farther south. These openings hardly deserve the name, as only a few sackfuls have been taken from each. In all of them the coal shows the same character.

This little bed is of much interest. Here in the vicinity of the Staunton pike is the northern termination or better, perhaps, the beginning of the important group of "conglomerate" coals so fully described by Prof. Fontaine, in West Virginia, which farther southward become the main source of supply in Tennessee. In the northern portion of the State no coal occurs in the conglomerate. The local geologist, quoted by Prof. Fontaine and myself, who asserted that two beds occur in this group, is an ignorant man, who regarded the Tionesta Sandstone as part of the conglomerate, and so placed the Tionesta coals in this group.

Lower Carboniferous,

My observations in the Lower Carboniferous were made along the east slope of Rich mountain at two or three localities between the Staunton pike and the Huttonsville bridle-path, a distance of somewhat more than 10 miles north and south. The results therefore are not of much importance.

The red shales were seen on the Staunton pike. There they are in part quite arenaceous, and are almost a thinly laminated shaly sandstone. Their thickness cannot be accurately determined at that exposure, but I take it to be a little more than 50 feet. They do not appear to contain any important deposit of iron ore, such as occur near the Pennsylvania line. Six miles south from the Staunton pike, the shales are entirely wanting, and the conglomerate rests directly on the limestone. The line of contract is finely exposed at several localities but at none better than at a place nearly two-thirds of a mile north from Mr. Bradley's house, where the limestone and conglomerate are seen in contact along a bluff for abont 30 ft.

The shales are of a deep red color, and the micaceous sandy layers are almost as deep red as the pressed brick on our house fronts. As a whole this series bears very close resemblance to the red shales of the Lower Barren Group, and might easily be mistaken for them. About fifteen miles north from the Staunton pike, at the gap made by Tygart river on its passage through Rich mountain, Mr. J. Woolley found these shales 200 ft. thick; their identity being certified by the conglomerate above and the limestone below. Within 20 miles south from that locality they have wholly disappeared.

The rapid thickening of the limestone is remarkable, contrasting strangely in this respect with those of the Coal Measures. Near the State line on Cheat river the limestone mass is barely 100 ft. thick, as ascertained by boring. In Randolph county, I saw a continuous exposure of nearly 400 ft. A space of 200 ft. is concealed, and below that a calcareous shale occurs, so that the thickness is not less than 700 ft. In Pocahontas and Greenbrier counties, the expansion is greater, reaching in the former to 800 ft. On the Staunton pike the topmost layers are exceedingly pure and very compact. They yield an excellent lime, and are the source of supply for the whole region to a distance of nearly 20 miles. Farther south the upper layers are quite impure, and are nearly calcareous shale. On the property of Mr. Bradley, a seam of *coal* occurs amid some shales in this mass, abont 250 ft. below the conglomerate. It is 2 inches thick, quite impure and very sulphurous. It is seen in a little run below Mr. Bradley's house.

The fossils obtained from this limestone were found chiefly in the upper layers and are similar to those procured in Monongalia county. The most common are *Spirifer Leidyi*, *Athyris subquadrata*,

Productus elegans, *Productus pileiformis*, *Hemipronites crassus*, *Allorisma sp.*, and *Straparollus planidorsatus*. These show the rock to be of the same age as the Chester group of the west. I had in my possession several fine specimens of *Lithostrotion canadense*, which were said to be from Randolph county, and I expected to find the St. Louis group well defined. No species belonging to that group fell under my observation, and I doubt whether the *Lithostrotion* came from this portion of West Virginia.

The strangest feature of the Lower Carboniferous of this region is the entire disappearance of the sandstones and shales usually found between the limestone and the conglomerate. Judging from Rogers' reports, one would expect to find them, not merely persistent but greatly expanded, as compared with more northern localities. At Westernport, on the Potomac, they are 650 ft. thick, and in Pocahontas county, that part adjoining Randolph on the *south*, they are 1,260 ft. Yet in Randolph county they disappear completely. A local anticlinal must have existed here during the latter portion of the Lower Carboniferous period.

(TO BE CONTINUED.)

"The Norfolk & Western RR. Company has just secured the franchises and works of the New River Railroad, and will immediately prosecute the construction of that road into the Great Flat Top Coal Region. This will furnish cheap coal for the company's own use and for its important local manufacturing industries, and will also provide a large business in coal transportation for shipment from Norfolk, where coal wharves are being located."—This item is appended to a circular of July 11th, 1881, sent us by Treasurer Wm. G. Macdowell. We have since learned that the purchase includes the franchises, etc., of the New River RR. Co. of Va., the New River RR. Co., of W. Va., the East River RR. Co. of W. Va., and the Bluestone RR. Co. of W. Va.; that all of these have been combined into the New River RR. Co., with F. J. Kimball, the First Vice-President of the Norfolk and Western, as President; and that 35 miles of the road have already been let for construction and that the remainder will be let in a few days, and the whole line to the coal-field be pressed to a speedy completion.

This railway, which will soon become one of the most important feeders of the Norfolk & Western, will, for the present, begin at New River station of the N. & W., the one on the west side of New river, (New Kanawha, properly), and not at Central on the east side, as shown on map in our June number, and follow down that river, on its west side, through Pulaski and Giles counties, Va., to the mouth of East river, a distance of 35 miles; thence, leaving New river, the road will either run across Mercer county, W. Va., southwest, up East river to its head, some 24 miles and thence across to the forks of Bluestone, some 6 or 7 miles further, where the border of the Great Flat-top Mountain coal field is reached; or it may follow East river to Five-mile creek and then go northwest, by way of Princeton, to the same coal-field lower down the Bluestone.—Of this branch and the coal-field it will open we shall have more to say hereafter. The map in our Feb., 1880, number, shows the location of the coal-field. The Coal-end line on the map in our last number was intended to run up Wolf creek; this purchase will change the location to East river on the opposite or north side of the mountain range and into W. Va.

Cincinnati, Ohio, Trade, 1879-'80.—By the courtesy of Supt. Sidney D. Maxwell, we have the 32d report of the Cincinnati Chamber of Commerce, that of the trade of that city for the fiscal year ending Aug 31, 1880. So much of the trade of the Virginias, especially that in coal and iron, is now with that great industrial city, we gather the following suggestive facts from this very complete report for the guidance and consideration of our readers:

The iron trade exceded that of any previous year. The actual receipts of pig iron were 107,694 tons; and the aggregate sales, from first hands, to go into consumption, were 248,519 tons, valued at $8,708,105, an average of $35.04 per ton. The shipments were 205,234 tons. In 1859-60, twenty years back, the receipts were 37,550 tons, and the shipments 4,667. The report says, "There is no limit that can be reasonably named to the expansion of this trade." The nails received were 532,933 kegs.—No. 1 charcoal pig, at the close of August, for the last 17 years, has ranged in price from $21 to $80 per ton, averaging over $40.

The lead and shot trade fell off during the year. Of lead 118,229 pigs were received, and the average quotation was $4.99 per 100 lbs. The receipts of shot were 1,113 kegs of 12 bags each, and the average price was $1.86 a bag.

Of pig iron 248,519 tons, valued at $8,708,105, or an average of $35 per ton, were sold from first hands to go into actual consumption, as against 212,281 tons in the previous year; and there were absolutely shipped from the city, during the year, 64,409 tons (as against 4,667 twenty years ago), besides the quantity sold for direct shipment from the furnaces to the place of consumption. It received 144,013 tons of manufactured iron. The nails received were 532,933 kegs. The average quotations for the year were: for No. 1 hot-blast charcoal pig $35.04 per ton.

The report says: "Nor is there a limit that can be reasonably named for expansion in this trade." The value of its pig iron business for the year was $8,708,105; that for 1868-69 was $1,767,000. It claims that nine states are tributary to it in the iron trade; states that made 876,445 tons of iron in 1879, West Virginia making 50,667 tons, (all bituminous coal and coke iron but 406 tons of charcoal iron) of this total.

Great Flat Top Coal.—The recent purchase of the New River RR. by the Norfolk & Western people, and the announcement, which we publish elsewhere, that that railway will, at once, be completed to the Great Flat-Top Mountain coal-field on the Bluestone river side of it, in Mercer county, W. Va., and Tazewell county, Va., will necessarily, in consequence of the effect likely to be had on the coal trade of the country by the introduction of a new and and great controling factor, create a strong desire to know what kind of coals this far-extending railway combination (see map in our last issue) will introduce to the markets. To gratify that desire with reliable information, we have procured the following analyses of samples from three beds of these coals, made by Messrs. Booth, Garrett, & Blair, of Philadelphia, July 11, 1881:

	No. 1.	No. 2.	No. 3.	No. 4.
Moisture	1.255	1.080	0.850	1.260
Volatile matter	20.175	18.630	20.630	30.107
Fixed carbon	77.675	72.170	72.750	59.616
Ash	0.895	8.120	5.770	8.233
Coke, per cent	78.570	80.290	78.520	68.633

No. 1 is of coal from the 11-ft. seam known as the "Nelson" bed; No. 2 is from the outcrop of a 9 ft. bed on Coal creek; No. 3 is from the outcrop of a 3½-ft. bed also on Coal creek.

The analysts say: "All the three samples coke well, that is in the small samples we had to deal with. No. 1, of course, is the best, having the least ash."

For comparison we introduce analysis No. 4, that of the "lump coal" from the Broad Ford mines of Frick & Co., in the celebrated *Pittsburg coal bed*, near Connellsville, Pa, made by A. S. McCreath, chemist of the Pa. Geological survey. (See Report M M., p. 22.)

The Coal and Coke Movement, from the mines, over the Chesapeake and Ohio R'y, for the month of June, 1881, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Mr. Charles M. Gibson, the Fuel Agent for the Company, were as follows:

	1880.	1881.
Fuel for use of Company	13,811	8,655
Shipped at Huntington on the Ohio river	8,662	16,642
Delivered on line of Elizabethtown, Lex'n & Big Sandy RR.	....	3,096
" " Chesapeake & Ohio R'y. west of Richmond	1,872	11,109
" at Williamson to Richmond & Alleghany Railroad.	....	282
" Staunton to Balt. & Ohio Railroad, Valley Division	....	....
" Waynesboro to Shenandoah Valley Railroad	....	222
" Charlottesville to Va. Midland R'y	2,988	3,740
" Gordonsville to do. do.	....	....
" Hanover Junction to R. F. & P. Railroad	344	503
" Richmond for consumption, including steam-tugs and dredges	2,481	5,579
Shipped at James River wharves	24,276	18,518
" Newports-News wharves	....	....
Total	54,434	68,346

The prominent comparative points of the June movement are: the gain of 25 per cent in the total traffic; the large decrease in fuel for use of Company; the increase of nearly 100 per cent in shipments down the Ohio; the new business with recently opened connecting railways; the increase of over 100 per cent in deliveries for Richmond consumption; and the large decrease in shipments by James river.

The tons of each kind of coal fuel moved during the same June periods, and the increase or decrease in the movement, were as follows:

Kind	1881	1880	Increase, 1881.
Cannel	2,202	4,549	.....
Gas	24,702	47,684	11,860
Splint and Block	13,655		
New R. & other steam	21,187		
Coke	6,600	2,201	4,399
Totals	68,346	54,434	13,912

The only *decrease* in 1881 was 2,347 tons in cannel tonnage.

The half-yearly movement, that for the first 6 months of 1881, and for the corresponding period of 1880, was as follows:

	1880.	1881.
Fuel for use of Company	65,579	69,521
Shipped at Huntington on the Ohio river	67,862	80,473
Delivered on line of Elizabethtown, Lex'n & Big Sandy RR		15,837
" " Chesapeake & Ohio R'y west of Richmond	13,902	60,077
" at Williamson to Richmond & Alleghany Railroad		817
" Staunton to Balt. & Ohio Railroad, Valley Divis.	76	197
" Waynesboro to Shenandoah Valley RR	....	698
" Charlottesville to Va. Midland R'y	20,352	27,561
" Gordonsville to "	151	284
" Hanover Junction to R. F. & P. Railroad	6,648	6,131
" Richmond for consumption, including steam-tugs and dredges	23,641	42,492
Shipped at James River wharves	81,218	102,591
" Newports-News wharves	.....	.....
Total	279,429	406,679

The movement during the first half of 1881 was 127,250 tons more than during the first half of 1880, a gain of over 45 per cent. The noticeable features of this statement are: the gain of over 18 per cent in shipments down the Ohio; the very considerable new business in deliveries to E. L. & B-S. RR. and to S. V. RR.; the very great increase of more than 332 per cent in deliveries for use on the line of the C. & O., largely in consequence of the development of iron manufacturing there; the gain of about 80 per cent in deliveries for Richmond, Va., consumption, and over 26 per cent for shipment by the James from Richmond. This half-yearly exhibit is, in all respects, a most satisfactory one, showing a healthy growth in the coal trade of the Chesapeake & Ohio Railway.

The tons of each kind of coal-fuel moved during the first 6 months of 1881, and during the corresponding period of 1880, and the increase of the movement, were as follows:

Kind.	1881.	1880.	Increase 1881
Cannel	7,476	20,415	.....
Gas	142,144		
Splint and Block	84,071	242,550	119,280
New R. & other steam	135,615		
Coke	37,373	16,464	20,909
Total	406,679	279,429	127,250

The only decrease in 1881 was 12,939 tons in cannel tonnage.

The noticeable features of the above statement are: the large decrease in the shipment of cannel coal, partly, we may say, in consequence of the closing of the Peytona mine and the restriction of this kind of coal to the mine of the Cannelton company, (a condition of things that will be changed when the branch railways up Paint and Cabin creeks, now in construction, are completed, so the excellent cannel beds there opened can be made available); the increase of about 50 per cent in the movement of gas, steam and splint coals; the large gain of over 126 per cent in the coke carried; and, as before stated, the increase of over 45 per cent in the total movement.

Virginia Blast-Furnaces.

Van Buren Furnace, Shenandoah county, Va., we are informed by Supt. Frank King, went into blast again this month, making in the first two weeks 84 tons of best charcoal car-wheel iron, very strong. The production is gradually increasing. This furnace is now, July 20, making over 50 tons of car-wheel iron a week. It has about 600 tons on hand, and is not making sales.

Low Moor Furnace.—In our May No., page 67, we reported the results of current operations at the furnace of the Low Moor Iron Co. of Va., Alleghany county, Va., to May 1st, 1881, the 189th day of this its first blast From May 1st, the 190th day, to July 2nd, the 252 nd day of current blast, including 6½ days of stoppages, the output of this furnace was some 4,258 tons, of various grades, of pig-iron, made from about 10,678 tons of ore, using some 5,736 tons of coke, 5,910 tons of limestone, and 992 tons of coal at the boilers. The average cost of labor was about $2.33 per ton of iron made during this period. The average daily product of the furnace was nearly 69 tons.—The total make of this furnace to July 2nd was about 17,345 tons; of this quantity 8,888 tons were made in 1880.

On the first of July, Mr. Geo. T. Wickes, C. E., who has been managing director at Low Moor since the beginning of operations there in 1873, resigned his position and removed to Millboro, Bath Co., Va., intending hereafter to give his attention to constructive engineering,—in fact, he is now, by contract, grading a railway from Goshen to California furnace for the Iron & Steel Ass'n of Virginia. Mr. Wickes has proven himself a thoroughly efficient engineer and manager, first, in opening the iron mines of the Low Moor Co. and marketing and giving a reputation to their ores, and then in the construction of the large modern furnace at Low Moor, the organization of its working force, and the successful working of the furnace for the first nine months of its blast, producing over 17,000 tons of iron. The burden of duties necessarily imposed on Mr. Wickes has been heavy, and he found it telling upon his health. We are glad he remains in Virginia, where there is work enough for men of his ability.

Col. H. W. Goodwin, who was the successful manager of the Peytona Cannel Coal mines, W. Va., for 13 years, became general manager of the Low Moor Iron Co. the first of this month. We welcome him to our vicinity and wish him great success in his new vocation.

Mr. C. F. Conrad, C. & M. E., who has heretofore had charge of the engineering work of the New River Coke Co., will, on the first of next month, (August) remove to Low Moor and become the resident engineer of the Low Moor Iron Co., taking charge of its extensive mining, quarrying, and other engineering operations. Mr. Conrad will find there a larger and more varied field for the exercise of his talents and experience.

Columbia Furnace, Shenandoah county, Va., John Wissler & Son, after being out of blast 3 months, started again July 1st. It made about 360 tons of charcoal car-wheel pig iron in the first 6 months of 1881. It uses Clinton, No. V, ores.

Liberty Furnace, Shenandoah county, Va., Wissler, Armstrong & Stone, has been running steadily since Jan. 1, 1881, averaging 42.5 tons product of charcoal, car-wheel pig iron a week, or 977 tons in the first half of 1881.—Liberty and Columbia have together sold about 700 tons of pig to Pittsburg, Baltimore and Richmond, and they had on hand July 1, about 750 tons.

The condition of the Va. blast-furnaces July 1, 1881, is reported by the *Iron Age*, of New York, as follows: (1) Charcoal, 31 stacks, 14 in blast, 17 out of blast. (2) Anthracite, 1 stack, out of blast. (3) Bituminous coal or coke, 8 stacks, 7 in blast, 1 out of blast.—This report gives Va. about 1-9 of all the charcoal furnaces in the U. S. and 1-10 of those now in blast; also 1-27 of those using bituminous coal and coke, and 1-21 of those now in blast. It would be well to drop from the list the "anthracite" out of blast, that of the old Powhatan Iron-Works, 5 miles above Richmond, on the R. & A. RR., for that, whenever it goes into blast again, will certainly use Virginia coke. Virginia is credited with 40 of the 733 furnaces in the U. S., about 1-8 of all; and with 21 of the 437 now in blast, or about 1-21 of all.

The weekly capacity of all the furnaces of the U. S. is stated as 7,427,628 tons a year; that of those now in blast, 96,705 tons a week, or 5,028,660 a year; that of those now in blast, 46,134 tons a week, or 2,398,968 tons a year. The charcoal furnaces now in blast have a weekly capacity of 14,596 tons; those out of blast, 9,614; the bituminous and coke ones in blast can produce 48,796 tons a week, those out of blast 18,545.

West Virginia Blast Furnaces.

The *Wheeling Iron & Nail Co.* and the *Belmont Nail Co.* are now relining their furnaces. Both expect to be ready to blow in Nov. 1.—*Pittsburg Telegraph.*

The condition of W. Va. blast-furnaces, July 1, 1881, is thus reported by the *Iron Age*, of New York: (1) Charcoal, 6 stacks, 1 in blast, 5 out out of blast. (2) Bituminous coal or coke, 6 stacks, 3 in blast, 3 out of blast.—This gives W. Va. 12 stacks, about 1-62 of all in the U. S., and 4 in blast, or about 1-110 of all those now in blast.

Quinnimont Furnace of the Pa. & Va. Iron & Coal Co., which, is stated on page 107, went out of blast June 15, for repairs, made about 4,000 tons of pig iron in 1881, to that date, most of which was marketed to the West. It had no iron on hand July 1.—During 1881, to June 15, there were taken from its mines 21,000 tons of coal, and made in its ovens 12,000 tons of coke. All the coke made was used at the Quinnimont, W. Va., and the Ferrol, Va., furnaces of the Co. Of the coal mined 1,600 tons were shipped to market, the remainder was used at the ovens and furnaces.

"**Connellsville** coke men will have to keep their eyes open. By the new connections from West Virginia the coke men of Kanawha have a chance at the western trade. Read this from the Ashland, Ky., 'Independent:' "Since last week 150 cars of coke have been received from W. Virginia by the C. & O. and E. L. & B. S. roads for transfer to Ironton. Several cars of coke have been sent over the Scioto Valley to Cincinnati and to Detroit manufactures to test its quality."—*Coal Trade Journal*, of New York, July 27.

Investigations on the Ore Knob Copper Process.

By T. Egleston, PH.D., School of Mines, Columbia College, New York City.

(Read at the Staunton, Va., Meeting, May, 1881, of the American Institute of Mining Engineers.)

The works of the Ore Knob Copper Company are situated in the county of Ashe in the northwestern part of the State of North Carolina, about ten miles from the Virginia line, at an elevation of 4,600 feet above the sea. The nearest railroad station is at Marion, Smyth county, Virginia, about forty-five miles distant. The roads from the railroad to the works have been constructed by the company for the transportation of their material, they are very hilly, and in certain seasons of the year in bad repair. Transportation is therefore always limited and never easy, although it is done by contract at a very low price. The main difficulty with transportation is not so much its cost as the fact that it puts a minimum upon the production of the works. These unfavorable conditions make it necessary for the owners of the mine to smelt their ores and to transport to market nothing except the metal, which alone will bear the high price of transportation.

The mine was opened previous to 1860, but has only been worked systematically during the last five or six years. The vein is a fissue vein from ten to twenty feet in thickness in the gneiss of the Laurentian period, and has been explored over a long distance by working and trial shafts, and has a strike of north about sixty degrees east. It is vertical, cutting across the strata of the country rock. One wall is always sharply defined, the other is in the rock; the ore dies out in it. Its penetration is very nearly constant but there is no seam to give a sharp separation. The gossan generally outcrops at the surface. When it does not it is covered by only a few feet of earth, so that there is no difficulty in following it, which has been done for nearly a mile. It is generally from forty to fifty feet thick over the ore, and the only dead work which has to be done is the piercing of this gossan to reach the ore. All the shafts and levels are in the ore itself, so that in the mine no dead work has to be done. Both the walls of the vein are vertical, and as they are very strong, the ore between them is all taken out, it being only necessary to leave sufficient of it between the walls to protect the shafts. Two of the shafts are sunk to a depth of three hundred feet, and two to two hundred and fifty each. Five other shafts to the north have been sunk at variable distances, the shallowest of which is sixty feet, and two others to the south are now being sunk on the gossan. Only two of the shafts are being used to raise ore at the present time. The others are either in poorer ore than these two shafts, or are not worked because it was thought advisable to follow the ore to the south where it seems to be running richer than toward the north. The ore consists of pyrrhotine mixed with chalcopyrite and quartz in variable proportions. Hardly any other minerals except a small amount of carbonate of lime, some little black mica, and occasionally garnet, can be seen in the rock.

The method of mining employed is known as underhand stoping, this method being the best suited for the character of the vein. The rock is hard, but the ore is won without much difficulty. Negro labor is employed to a very large extent, and, so far as my experience goes, I have found it as good, if not better than white labor, and much more tractable. The wages paid are low, but the work performed is equal to that done elsewhere, for while the actual money paid is small in amount, its purchasing power is as great, or even greater, than a much larger amount paid elsewhere. The store system, which is adopted, allows of the miners getting good and substantial articles, which are furnished them at a much lower price than they can purchase them elsewhere, thus rendering them contented, and it besides yields a large revenue to the company.

The method of extraction is by iron buckets. These hold from 1,600 to 2,000 pounds each. They are placed on a truck which, when filled with ore, is rolled to the shaft, and the buckets are there hoisted.

The ventilation of the mine is excellent, the foul air of a a blast being removed in a very short time.

The mine was originally opened on a very rich streak of chalcosite running at times as high as 30 per cent in copper. The works which were constructed to treat it were for the Hunt and Douglass process, which has been described in full. (See Engineering, London, Eng., vol. xxii., p. 419.) This process was worked on a large scale until the amount of carbonate of lime which came into the ores rendered it impossible to use that process any longer. It was then abandoned and the present works built. The ore became rapidly poor, and no traces of chalcosite are now seen in the mine.

The smelting works are situated only a few hundred feet from the mine. The ore is delivered into the dressing-house, where that containing copper is separated from the sterile material, and is then discharged into a car running by gravity to the smelting works, where it is dumped into carts and carried to the piles to be roasted.

After a series of experiments, extending over many months, it has been found that an ore containing 3 per cent of copper just pays the expenses of mining and smelting. There will, consequently, be a loss at Ore Knob, under the present conditions, in working an ore of a less, and a profit in working those of a higher yield.

As the mine and the works are so near together no special provision for storing the ore is made except in the roasting piles. The ore goes from the mine to the dressing works, and from there it is delivered directly to the roasting-piles. There are about two thousand tons of poor ore, however, lying upon the surface, broken and ready to work whenever a process can be found to work them, or when the price of copper shall be high enough to make it worth while to mix this ore in small quantities with the ore as it comes from the mine, or to treat it by itself.

Analyses No. 1 and No. 2 show the mineralogical composition of the ore taken from each of the two shafts of the mine. No. 3 is a sample taken from the heaps of poor ore lying on the surface.

	No. 1.	No. 2.	No. 3.
Chalcopyrite,	11.33	13.30	4 76
Pyrrhotine,	37.46	35.74	48.78
Sesquioxide of iron,	8.14	16.34	18.36
Alumina,	1.84	1.49	....
Manganese,	0.16	0.50	0.76
Lime,	5.32	7.84	7.21
Magnesia,	0.35	0.94	0.30
Carbonic acid,	4 76	7.19	6.00
Zinc,	0.67	0.66	0.65
Cobalt,	0.09	0.09	0.095
Nickel,	0.71	0.92	1.08
Silicious residue,	29.10	13.57	12 80
	99.93	98.58	100.79
Metallic copper in the ore,	3.92	4.60	1.65

Alkalies, etc., not determined.

These analyses show the ores to be of exceptional purity. No trace of arsenic or antimony could be found in any of the samples

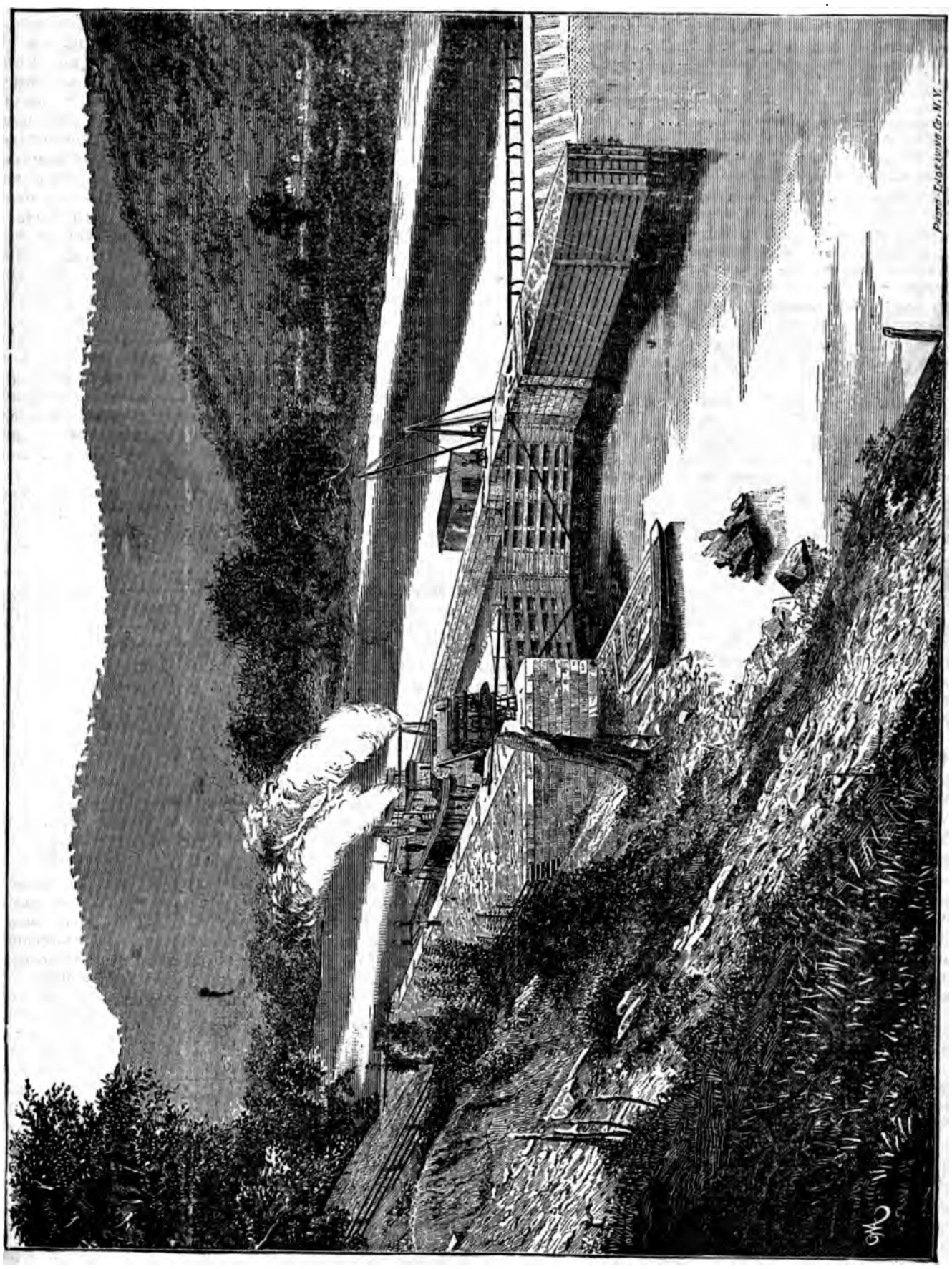
About fifty per cent of the ore mined is sent to the smelting works. The amount of ore mined in June, 1880, was 2,171.7 tons; that sent to furnaces was 1,413.5 tons, which is a per centage of 65 per cent. The amount of ore mined from July 1st to 8th, 1880 (6 days), was 564 tons; that sent to the furnaces was 320 tons, or 56 per cent.

The ore might be enriched much further by careful hand-picking. No dressing in the ordinary sense of the word is applicable to it, since the pyrrhotine and chalcopyrite are of very nearly the same specific gravity. No effort is made at dressing except with the fines, and the only attempt then made is to get rid, in a rough way, of part of the quartz in the ore.

The following interesting summary of the cost of mining from January 1st, 1879, to April 1st, 1880, was taken from the books of the company by Mr. J. E. Clayton.

Cost of labor, for fifteen months,*	$27,706.11
Cost of powder, fuel, candles, etc.,	$3,499.24
Cost of carting, per ton of ore,	$ 0.815
Quantity of ore delivered in mill-house,	38,372 tons.
Ore delivered yielded in furnace ore	21,223 tons.
Proportion of furnace ore to ore delivered,	55.1 per cent.
Average yield of the ore,	6 per cent.
Yield of furnace ore from ore mined, 1876,	33 per cent.
Yield of furnace ore from ore mined, 1877,	34 per cent.
Yield of furnace ore from ore mined, 1878,	48 per cent.
Yield of furnace ore from ore mined, 1879 and 1880, to April 1st,	55.1 per cent

*The labor of sinking over three hundred feet of shafting and all the development in the mine is included in this amount.



View of Lock and Dam No. 4, near Coalburg, W. Va., of Great Kanawha River Improvement, from below.

This is one of the Chanoine *movable* dams. A portion of the dam is seen on the right, with the service bridge above it. The normal lift of this lock is 7 feet; width at bottom, 50 feet; and length between quoins, 300 feet.—The characteristic topography of the Great Kanawha coal-field is well shown in the cut; a narrow stream-valley, from which the broken, coal-bearing escarpment of No. XIII rises steeply from 500 to 1,000 feet.

The Great Kanawha River Improvement.

In 1875 the General Government began the permanent improvement of the navigation of the Great Kanawha river, West Virginia, by the construction of dams and locks; up to June 14, 1880, the appropriations made for this purpose amounted to $1,142,000. In addition to this amount the last Congress made a liberal appropriation and the work of improvement is progressing satisfactorily.—In the Annual Report of the Chief of Engineers, U. S. Army, for 1880, just received, we find a full account of the work of this Improvement to June 30, 1880 (the close of the fiscal year 1879–80), illustrated by four plates of the work at dams No. 4 and 5. From that and previous reports we gather the following facts, reproducing, by the courtesy of the Chief of Engineers, the illustrations m ntioned, as we find room for them.

Previous to 1875 the General Government made some temporary improvements to the towing-channels of the river; that year it began the permanent improvement having for its object the giving of a constant navigable depth of at least 7 feet throughout the whole length of the Great Kanawha to its mouth at the Ohio.—This, says the report for 1880, will be a great step forward for that country, as navigation at low-water has hitherto been entirely suspended or limited to boats of very small draught, notwithstanding the fact of there being always an abundance of water if properly utilized.

The object aimed at is to collect the water-supply by dams,

making at low-water a succession of navigable pools connected by large locks. The peculiarity of most of the dams is that they can be lowered when the stage of the water in the river will suffice for navigation over the shoals. This gives them the name of movable dams, and enables an open river to be had when the water is high enough.

The Great Kanawha, as the name is now limited, is the navigable river, 94.2 miles long, that extends from the foot of the Kanawha Falls to the Ohio, falling in that distance 107.92 feet. The average slope from the falls to Paint creek is 3.5 ft. per mile; thence to head of Charleston pool 1.5, and thence to the Ohio 0.8 ft. per mile. The width of the river is from 550 to 600 ft.

The plan of improvement adopted (in 1875) contemplates the construction of 12 locks and dams, numbered from above down the river and located as follows:

No.	Location.	Miles from Falls.	Lift, in ft., of Locks.
1.	Near foot of Loup Creek shoal	4.50	15.0
2.	Foot of Lykens shoal	9.19	15.0
3.	Foot of Paint Creek shoal	15.12	15.0
4.	Near foot of Cabin Creek shoal	21.28	7.0
5.	Near foot of Catfish shoal	27.31	7.0
6.	Head of Island shoal	39.69	7.0
7.	Head of Newcomer shoal	43.22	6.5
8.	Near head of Johnson shoal	52.46	7.0
9.	Head of Red-house shoal	61.77	6.5
10.	Near foot of Gillespie ripple	67.36	6.0
11.	Head of Debby ripple	75.00	7.0
12.	Foot of Three-mile bar	92.40	8.7

The construction of locks 4 and 5 was let to contract in 1875; that of dam 5 in 1876 and of dam 4 in 1877. Lock 3 was begun in 1873 and dam 3 in 1879.

Dams Nos. 1, 2 and 3 are to be *permanent*, as the declivity of the stream above No. 3 is too great to admit the advantageous use of the movable system; all the others will be *movable*. All the locks will be 300 ft. by 50 ft. in the clear.

June 30, 1880, locks and dams 4 and 5 are reported as essentially finished, according to the Chanoine system. They are now in use.—We give in this number a view of Lock No. 4 (the one 15¼ miles above Charleston ferry and near Coalburg) from below. A portion of the movable dam is shown with the service bridge above it. The normal lift of this lock is 7 ft.; width at bottom 50 ft.; and length between quoins 300 ft. This dam makes a pool or harbor for the extensive coaling operations at and near Coalburg.

Dam No. 5, 9⅛ miles above Charleston ferry and near Brownstown, has a pass 250 ft. wide and a weir 265 ft. long; the movable portion of the dam is 5 ft. high. The lock there is 300 ft. by 50 in the clear. These are now in use.

Lock No. 3, near Paint creek, 21.5 miles above Charleston ferry, was at this date well under way; it will create a pool extending up to Cannelton, a very important coal-mining point 27.5 miles above Charleston ferry.

Sites for dams 6 and 7, at points 4 and 14 miles, respectively, below Charleston ferry, had been secured when the 1880 report was made. No. 7 is now (1881) in process of construction.

In reference to No. 2 the report says: "Considerable effort has been made by those interested in the development of coalfields and other properties above Cannelton to bring about the beginning of lock and dam No. 2. The best location of these is at Cannelton. The owners of that property do not wish to be disturbed, apparently taking no interest in the improvement of the river, but preferring to depend on the railroads for the transportation of their highly valuable coals. After negotiation with that company it has seemed best to abandon the effort to locate No. 2 on their land, but to take it down the river a little distance, though the new location, from an engineering point of view, will not be so favorable. Its advantageous effect on the river above will, however, be the same as if located at Cannelton. Attention will be given at once to procuring the new site for No. 2, and the location will be occupied as soon as possession is obtained."

Col. Wm. P. Craighill, who has general charge of the improvement, says: "Experience has now demonstrated that the estimated cost of each site, with its lock, dam, and appurtenances was correctly placed at $350,000. As, in proper progress, at least one new site should be occupied each year, this sum of $350,000 is the least that should be appropriated in each year. It is plain, however, that as the whole system could be completed in the same time as any one of the similar parts, by far the most advantageous course, looking to the utilization of the whole improvement, whose benefits cannot be fully realized until it covers the whole river, would be to make available the whole remainder of the estimate for completion, $2,410,000. The whole work could then be finished, probably in two, certainly in three, years."

Lieut. Thomas Turtle, Corps of Engineers, who had immediate charge of this improvement during the period of the 1880 report, says, in his report: "The object of the present improvement is to obtain and furnish a constant navigable depth of at least 7 feet from the coal-fields of the Kanawha to the Ohio river. This object is to be obtained by a series of dams, with locks, from the upper limit of the coal-field to the mouth of the river. The dams from the foot of Paint Creek shoal upward are to be fixed dams, and all navigation through them will have to pass through the locks. The river below these fixed dams is to be improved by the construction of locks with movable dams. When the stage of water is low, boats and barges pass through the locks, but when the stage of water permits navigation in the open river, all traffic passes unimpeded through openings in the dams provided for that purpose."

We may add that this improvement, even in its present incomplete condition, has had a marked effect on the coal trade of the Great Kanawha because of the increased facilities furnished for the movement and storage of barges, enabling miners and shippers to continue the loading of coal when the water is low; when the improvement is completed, as the engineers say, there will be water enough for navigating the river at all seasons. New mines, to rely upon the river for transportation, are being opened, and the capacity of old ones is being largely increased, some of the largest ones doubled, by extensions of entries, the introduction of coal-mining machinery, and the building of new wharves and tipples. In consequence of this improvement and the extension of the Chesapeake and Ohio Railway to western connections, the Great Kanawha coals are now becoming a somewhat important factor in the western coal trade, and entering upon the position that naturally belongs to them and that eventually they will hold in that trade.

Recent Analyses of New R. Coal and Coke.—During the present month Mr. Andrew S. McCreath, chemist of the Geological survey of Pennsylvania, made the following analyses of coal and coke from Fire Creek colliery of the New River coal-field, on the C. & O. Ry., Fayette county, W. Va.:

	Coal.	*Coke.*
Water	0.735	0.102
Volatile matter	22.425	0.492
Fixed carbon	75.499	91.940
Sulphur	0.536	0.538
Ash	0.805	6 928
	100.000	100.000
Color of ash	Reddish brown.	Reddish gray.
Coke per cent	76.84	. . .
Phosphorus	. . .	0.008

The coal giving the above results was sampled from the "lump" coal as sold from these mines. Mr. McCreath writes,—"I was a little surprised at the low ash in the coal; but duplicate tests were made with great care. The analysis represents a coal of remarkable purity, and it should yield a coke with only a little more than 1 per cent of ash and about one-half of one per cent of sulphur."

The coke of the above analysis was from the piles at the ovens of Fire Creek colliery; a coke made from the "slack" of the mine and therefore containing all the impurities of the mine, including the chippings of slate from roof and floor incident to mining operations. This explains why the percentage of ash is so much larger, in proportion, in the coke analysis than in that of the coal.—By using "lump" coal in coking operations, a coke could be made having the purity which Mr. McCreath says one should have made from such coal.

The output of coal at the *Fire Creek* colliery for the first half o 1881 was about 45,000 tons; that for this month will be nearly 9,000. It has recently been filling an order for coke for St. Louis, thus opening a trade beyond the Mississippi that will grow to large proportions when consumers learn the exceptional purity of this fuel from the southeastern side of the Great Ohio Coal Basin, from New River, Great Flat-top, etc.

We commend the above analyses to the attention of the very ably conducted, but somewhat near-sighted, *Keystone Courier*, of Connellsville, Pa. It was evidently short of information when it uttered the following in its issue of May 20, 1881:—"The truth is that there is coking coal in the Virginias, but it is vastly inferior to that of the Connellsville region, and its owners would make better headway in selling the same by frankly admitting this fact."

We are, however, encouraged in reference to the condition of our worthy cotemporary; he is evidently improving, possibly in consequence of a longer and more careful reading of THE VIRGINIAS, for in his issue of July 15, 1881, we find this remarkable admission:—"The Connellsville region is no longer the only place where coke is manufactured, though we contend always, that we turn out the best article in the market. However, in the development of the mineral resources of the Virginias coke-making is being developed."

American Institute of Mining Engineers; List of Members and Associates that attended the Virginia Meeting of 1881:

Ashburner, C. A. . . . . Philadelphia.
Atkins, Wm. . . . . Pottsville, Pa.
Biddle, Wm. F. . . . . Philadelphia.
Benise, Henry . . . . . New York City.
Blackwell, H. G. . . . . Lynchburg, Va.
Bowron, J. . . . . South Pittsburg, Tenn.
Bowron, W. M. . . . . Shenandoah Iron Works, Va.
Bramwell, G. W. . . . . Stone Cliff, West Va.
Bramwell, J. H. . . . . Ironton, Ohio.
Brinsmade, H. N. . . . . Lake Mahopac, N. Y.
Brinsmade, J. B. . . . . New York City.
Buck, S. M. . . . . Coalburg, W. Va.
Burden, H. . . . . Troy, N. Y.
Burden, I. T. . . . . " "
Burden, J. A. . . . . " "
Burnham, Wm. . . . . Philadelphia.
Canfield, F. A. . . . . Dover, N. J.
Chamberlain, H. S. . . . . Chattanooga, Tenn.
Chance, H. M. . . . . Philadelphia.
Comstock, G. S. . . . . Mechanicsburg, Pa.
Constable, C. . . . . Constableville, N. Y.
Cornell, A. B. . . . . Youngstown, Ohio.
Coryell, Martin . . . . . Lambertville, N. J.
Coxe, W. E. C. . . . . Reading, Pa.
De Camp, W. S. . . . . New York City.
Dewey, F. P. . . . . Chattanooga, Tenn.
Drinker, H. S. . . . . Philadelphia.
Drown, T. M. . . . . Easton, Pa.
Dudley, C. B. . . . . Altoona, Pa.
Egleston, T. . . . . New York City.
Enos, A. T. . . . . Brooklyn, N. Y.
Evans, John D. . . . . Chester, N. J.
Ferguson, E M. . . . . Pittsburg, Pa.
Firmstone, H. . . . . Longdale, Va.
Frazer, P. . . . . Philadelphia.
Frazer, Robert . . . . . Wilmington, Del.
Heinrich, O. J. . . . . Drifton, Pa.
Hewitt, Charles . . . . . New York City.
Hewitt, Cooper . . . . . "
Holbrook, L. . . . . "
Hotchkiss, Jed . . . . . Staunton, Va.
Hutchinson, E. S. . . . . Coalburg, W. Va.
Johnson, J. E. . . . . Longdale, Va.
Johnston, W. N. . . . . Buchanan, Va.
Jolliffe, Wm. . . . . "
Kennedy, J. S. . . . . Rocky Mount, Va.
Kent, W. St.G . . . . . Cold Spring, N. Y.
King, Frank . . . . . Van Buren Furnace, Va.
Kirchhoff, C. Jr. . . . . New York City.
Knox, John H. . . . . Andover, N. J.
Lewis, J. B. . . . . Dover, N. J.
Lewis, J. F. . . . . Quinnimont, W. Va.
Lilly, Wm. . . . . Mauch Chunk, Pa.
Lorenz, Wm. Jr. . . . . Philadelphia.
Lyman, F. . . . . Low Moor, Va.
Marshall, G. C. . . . . Uuniontown, Pa.
Martin, R. L. . . . . Fairchance, Pa.
Maury, M. F. . . . . Salt Petre Cave.
McCandless, E. V. . . . . Pittsburg.
McClellan, Arthur . . . . . Drifton, Pa.
McCreath, A. S. . . . . Harrisburg, Pa.
McLeavy, John . . . . . Dunbar, Pa.
Metcalf, Wm. . . . . Pittsburg, Pa.
Mickley, Edwin . . . . . Hokendauqua, Pa.
Moffat, E. S. . . . . Stanhope, N. J.
Morris, S. Fisher . . . . . Quinnimont, W. Va.
Morris, W. H. . . . . Pottstown, Pa.
Neilson, James . . . . . Youngstown, Ohio.
Ormrod, George . . . . . Emaus, Pa.
Page, W. N. . . . . Ansted W. Va.
Potter, E. C. . . . . Chicago, Ill.
Pullman, J. Wesley . . . . . Philadelphia.
Rand, A. C. . . . . New York City.
Raymond, R. W. . . . . "
Riley, L. A. . . . . Ashland, Pa.
Roberts, Percival J. . . . . Philadelphia.
Rogers, E. L. . . . . Baltimore, Md.
Rundall, C. A. . . . . Ferrol, Va.
Sharples, S. P. . . . . Boston, Mass.
Sherrerd, J. M. . . . . Secaucus, N. J.
Strausz, Alex. . . . . Raccoon, W. Va.
Strode, H. A. . . . . Amherst Court-house, Va.
Stutz, S. . . . . Pittsburg, Pa.
Taylor, W. J. . . . . Chester, N. J.
Thomas, D. H. . . . . Alburtis, Pa.
Thomas, Samuel . . . . . Catasauqua, Pa.
Thompson, E. Ray . . . . . Troy, N. Y.
Van Voorhis, W. W. . . . . Manhattanville, N. Y.
Vezin, H. A. . . . . Philadelphia.
Ward, W. P. . . . . Savannah, Ga.
Watts, E. . . . . Verta, Lancaster Co., Pa.
Whitney, Eli Jr., ... New Haven, Conn.
Wickes, Geo. T. . . . . Low Moor, Va.
Wiley, W. H. . . . . New York City.
Witherbee, F. S. . . . . Port Henry, N. Y.

Va Meeting Meeting of Am. Institute of M. Eng'rs.—The response of Prof. P. Frazer, Vice-President of the Institute, to Col. H. C. Parsons, V. President of the R. & A. RR., at the Natural Bridge of Va., June 4, 1881:

Gentlemen of the Richmond & Alleghany RR., of the committee which has so handsomely entertained us, and the ladies who are not included in these two classes:—I have but one word to say prefatory to those few words which I have the honor to address to you in behalf of the Institute in response to the speech of Mr. Parsons. One of our worthy Presidents of the Institute of Mining Engineers, on a similar occasion, called upon to respond to an able speech like that we have just heard, compared himself—and I compare myself—to the object of pity of Deacon Smith. Many of you have heard that story. Deacon Smith was a good, kindly, artless old gentleman who hated to see any living thing suffer. One day as he was passing along the road he saw a toad in a fence corner exposed to the burning sun. The Deacon stopped his horses, got down from his seat, picked up the toad and laid him in the shade of his wagon. Then he mounted his wagon and drove off. Ladies and gentlemen, I feel that I am that toad. I have but very little that I can add this time in the way of information to what Mr Parsons has so ably said. It has been my privilege and at the same time my duty to study part of this region through which the R. & A. RR. now passes, and though I cannot say from my own personal observation, as our kind entertainer says, that all the ores of iron can be found within that belt he has alluded to, I can join with the utmost sincerity in all that Mr. Parsons has said in regard to its mineral wealth. But I have a trifling comment to offer—one in relation to the project of causing the manufacture of cheap iron. I suggest that there are many members of the Institute—otherwise worthy men—to whom the announcement will not prove pleasing.

We are assembled here, ladies and gentlemen, on a spot that is sacred to the memory of our childhood. It is here within a short distance that we have seen that magnificent structure—that Natural Bridge, which woke the admiration of George Washington. We are standing together under the shadow of that great spirit which has hitherto overtowered every other man who ever rose in American history, and it is with reverence and respect, nay it should be with silence, that one should greet his neighbor and brother on a spot so sacred as this. Yet how different the feelings which inspire us. All of us have seen in our early geographies the picture of the Natural Bridge given like the pictures of plantation labor, as if it, like the coon and the tobacco, was one of the products of Virginia. Some of us gaze wondering at the 216 ft of this bridge and wonder what sort of a base ball player George Washington must have made if he threw a stone over this arch from below, as is reported. Those who believe the story of this great climb, wonder which earned the epithet of "natural" the bridge or the boy. Some of us regard the bridge with covetous eyes and think with what economy of powder a second Glendon blast could be accomplished here. Some of us—the sentimental—smiling, call it a bridge of sighs, and the matter-of-fact reply, yes, of great size.

The history of the glorious Old Dominion resembles a game of whist. She led under Powhatan from a strong suit of clubs. Diamonds (the conventional emblem of riches) poured from Virginia from her earliest history to the present time. Her hearts were ever strong and full and many a life has been staked to win one. But not only was the side hand strong but the leaders were numerous.—The grand old Mother of Presidents, the mother of Jefferson, Madison, Monroe led out her court cards proudly. Thus, till now, everything strong in the political game of whist has been played, but one, and that she defiantly leads now—trumps. For *spades* are trumps, and most of these gentlemen before me have borne their parts in the enterprise fostered by the pick and spade. Rich as has been Virginia, her riches have not always appeared as they ought to have done. Yes, Virginians have had ores and iron which were from Ohio, Pennsylvania, New York, New Jersey and many other states, but, thank the spirit of progress and the good star of the regenerated Virginia that now you are going to use not Penn-

Craig Creek Basin,—Its Iron Ores, etc.—Editorial.

We have been furnished the following analyses of iron and manganese ores from Craig county, Virginia, recently made by Dr. S. P. Sharples, State Assayer of Massachusetts, 114 State street, Boston:

	No. 1.	No. 2.	No. 3.
Metallic Iron,	57.71	52.36	6.83
Silica,	1.05	2.90	2.55
Phosphorus,	0.63	0.011	0.10
Sulphur,	0.10	0.71	traces.
Manganese,	3.50	none.	49.48
Water	13.00	19.21	....

No. 1 is ore (Red-shale of V, or Clinton, probably) from the old furnace bank on N. W. side of Peter hill, S. W. side of John Creek Valley, some 5 miles above and W. from New Castle.—*No.* 2 of a porous, spongy-looking limonite ore (from No. VII, Oriskany) from the S. E. side of Craig Creek mountain some 3 miles S. W. from New Castle.—*No.* 3 is of a low-grade manganese ore, fairly well suitable for *spiegeleisen*, from the same locality as No. 2, but associated with iron ores of No. V.

These ores of iron are both remarkably low in silica, and the second one in phosphorus. The "phosphorus units" of the latter, amounting to less than 3 per cent, adapting it to all the fanciful requirements of the Bessemer steel manufacturers.

In view of the fact that the westward extension of the Richmond & Alleghany RR. (now forming a part of the Richmond, Alleghany, & Ohio Central RR.) will almost certainly go up Craig creek, where surveys for it are now in progress, pass through Craig Creek mountain by a tunnel, then go down Sinking creek to New river, and. thence to the Ohio, as we have always insisted it should, giving it the lowest grade route, and therefore the cheapest one for transportation from the Chesapeake to the Ohio, we spent part of the second week of this month in a partial re-examination of the topography and of the mineral resources of the Craig Creek country; which embraces the N.W. part of Botetourt county and the larger portion of Craig county.

Craig creek, a head-stream of the James that interlocks with Sinking, Stony, and other creeks of New river, has an air-line length of about 40 miles; midway of this length, near New Castle, the county-town of Craig county, a place about 1,250 feet above tide, two parallel flowing and nearly equal streams, John creek, or the right-hand fork, from the N.W. side of the county, and Craig Creek, or the left-hand fork, from the S.E. side, both running N. E., unite and form Craig creek proper, which, continuing the same course, but with a very winding channel, enters the James opposite Eagle Rock station of the Richmond & Alleghany RR., a place 18 miles S.E. from the C. & O. junction of that road at Williamson, and 932 feet above tide. Sinking creek, heading between the forks of Craig creek, flows S.W., in a direction opposite to that of Craig creek, into New river. Patterson creek, some 10 miles air-line long, runs parallel to lower Craig creek and enters it near its mouth. Here, as in all the Apalachian country, the streams and mountain ranges, the branches as well as the main ones, run nearly parallel.

Potts Creek mountain, the S.W. extension of the Middle Rich-patch mountain range, rising to an elevation of about 3,300 ft. above the sea and about 2,000 above the lower part of John Creek valley, bounds the upper part of Craig Creek basin on the N.W., separating it from that of Potts creek, which is more elevated.

Eastern Rich-patch mountain and its extension form the N.W. boundary of the lower part of the basin, to near New Castle, where Barber creek first and then John creek cuts through it. Beyond New Castle, at the John creek break, this mountain, extended, becomes canoe-shaped, or double, forming a U, about 30 miles long, that opens S.W. towards New river, with the limestone (Nos. II and III) valley of Sinking creek between the arms, the westerly one being John Creek mountain, not as high, by several hundred feet, as Potts Creek mountain, and the easterly and higher one being Craig Creek mountain, extended as Gap mountain; broken foot-hills, as knobby spurs or short ranges parallel to the main ranges, flank the sides of these mountains.—The curve end of the U, near New Castle, is partially broken down by the outflowing of Stone run, a bold mill-stream, into Craig creek. Brush, Price and North mountains, in order from the S.W.,—the latter doubled towards the James, with Patterson Creek mountain as an arm on the N.W., with Patterson creek between,—bound Craig Creek basin on the S.E.

The Geology of Craig Creek basin, briefly summarized, is this. (See geological map and sections on back of it in Vol. I of THE VIRGINIAS, page 92).—The easterly mountain chain, Brush-Price-North, is mainly made, as to its crests and easterly slopes, of Rogers' formation No. X, faulted on the east, where its "lowest Va. coal measures" are exposed and worked to some extent in Botetourt and Montgomery, flanked on the west by IX and VIII, which form the rugged spurs on the Craig side of the chain. The stream-valleys of Patterson, Craig and John creeks are eroded from No. VIII slates, shales, etc., among which beds of good slate are said to have been opened above New Castle; Patterson Creek mountain is made from VIII, and perhaps IX in part. The Eastern Rich-patch chain, as extended by Craig Creek and Gap mountains, on its east side, is the easterly abutment of a great geological arch, or arches, in which are exposed, at irregular heights, going up the the mountain from Craig creek, all dipping to the eastward, (1) the shales and slates of VIII, (2) the rotten sandstones of VII and their thick beds of limonite (brown hematite) iron ore (No. 2 of above analyses), (3) occasionally the limestones of No. VI, as near Roaring Run and Grace furnaces and on the banks of Craig creek above New Castle, and at points far up the sides of the mountains, (4) the Clinton sand-rocks and shales, No. V, including three strata of iron ore and manganese beds, 1 and 3 of above analyses, and (4) the sand-rocks of No. IV, forming the crests of the chain. The eastern side of Potts Creek mountain, at least where we crossed it near Hanging rock, has the same structure, except that V forms the crest. The westerly side of John Creek mountain probably shows the same rocks, but dipping westwardly, but where we hurriedly examined its slope in Peter ridge spur, the rocks are apparently inverted. Sinking creek runs, or rather runs and sinks, in a valley of Valley limestones and slates, II and III, and the opposite Craig and John Creek mountains expose outcrops of III and IV, dipping in opposite directions—that is, the valley is eroded from an anticlinal ridge.

The iron ores that are here exposed for 40 miles on the face of the mountain ranges, Eastern Rich-patch and Craig Creek, fronting Craig creek and bounding its valley on the northwest,—the ores that have been opened and worked at Callie, Roaring Run, and Grace furnaces, and that arrest, by their extent, the attention of every passer-by,—we found exceptionally abundant in quantity and variety, and, as the analyses given show, most excellent in quality. The limonites of the Oriskany, VII, and three varieties of Clinton, V, ores, a manganese ore and the limestone of VI, Lower Helderberg, extending in irregularly parallel outcrops over and along the face of the entire chain. (One of these Clinton ores, not yet analyzed, in the lower portion of the formation, which gives promise of excellent quallity, we found more abundant than we have ever seen it elsewhere.) The same ores are along the other mountains that we have named as formed from Upper Silurian rocks, IV–VII, so we are within bounds if we say the Craig Creek basin has 100 miles of length of iron-ore belts, with four varieties of iron ore, accompanied by limestone exposures (two kinds, II and VI, in places), within its borders.

The Chesapeake & Ohio and the Richmond & Alleghany railways, as now in operation, bringing the remarkably pure coke of the New River coals—a coke as good as any known see analysis of that from Fire Creek, given elsewhere—to the northwestern side and the northeastern portion of the James-New river group of Upper Silurian mountains of the Virginias—and opening ways to market, have caused the develment and working, in that group, of a dozen mines, and the construction of the great furnace at Low Moor and the one at Callie, and preparations for large furnaces at Wilton and Roaring Run. The extension of the Richmond and Alleghany RR. up Craig creek, along the eastern side of this group—the nearer to it the better for both the railway and the country—and around its southwestern end along New river, into the same New River coal-field, and the extension of the Norfolk & Western RR. down New river, along the same end of this group, and thence, by a nearer route, to the same coals, where

Coal Mining in W. Va in the 10th Census Year.

Hancock County, on the Ohio, the northern one of the State and of the "Panhandle," had 7 coal mines operated that produced each over $500 worth of coal; they were those of Reuben Hobbs, S. G. Hineman, G. W. Davis and Fred. Myers, of New Cumberland, who claim to mine bituminous coal, and W. L. Matthews, Robt. Miller, and Phil. Dawson, of Fairview, who call their coal semi-bituminous. All the mines are in a 3½ ft. bed. About 50 men were engaged in mining for about half the year, producing about 525,000 bushels of coal valued at about $21,750. These mines have a capacity for producing some 700,000 bushels a year. They were opened at various times since 1849. The most productive one, R Hobbs', furnishes coal to steamboats on the Ohio. The others supply local demand at New Cumberland and Fairview.

Wood County, of which Parkersburg is the county town, fronts on the Ohio and is crossed by the Little Kanawha river; the Parkersburg branch of the Baltimore & Ohio RR. also crosses the county. During the 10th-Census year 19 coal mines were worked in this county, producing some 24,500 tons of coal, all from a 5-ft. bed, called semi-bituminous, which appears, from Dr. Stevenson's paper, to be the Upper Freeport, of Pa., the No. VI of Ohio, the one under the Mahoning sandstone, the "black-flint ledge" of the Great Kanawha, and therefore a bed of the Lower group, Rogers' No. XIII, brought up by the great "oil-break" fault that crosses this county. The large mines of the county are those of the Volcanic Oil Co. and those of Michael Beam, which together produced some 14,500 tons, and which have a capacity for producing 21,000 tons a year. The mine of Geo. W. Overton, of Volcano, produced in bushels (28 to the 2,000-lbs. ton), some 10,000, that of S. R. Strickler, some 7,500; the other mines that produced 1,000 bushels and over each, were those of Joshua Webb, T. O. Bennington, A. F. Davis and L. W. Morris.

Tyler County, bordering on the Ohio, had no coal mines worked to any extent; in fact, none but a few small ones in the back part of the county for domestic use.

Lewis County, of which Weston is the county seat, is chiefly drained by the headwaters of the West fork of the Monongahela, but the western part is drained by branches of the Little Kanawha. The eastern outcrop of the Pittsburg bed of the Upper group, crosses the south corner of the county. During the 10th-Census year 72 coal mines, most of them small, were worked in this county, producing about 5,000 tons of semi-bituminous coal. The largest mines were those of Jacob Acheson and Richard Barrett, near Weston, and that of Nathan Brush of Gaston, which produced some 48,000 bushels, (28 to the ton) and have a capacity for some 65,000 a year. Of mines in Weston district 15 are reported as in a 6-ft. bed and 4 in a 4-ft. bed; the 10 in Willey are in a 6-ft. bed; the 8 in Sheridan and the 12 in Jane Lew are in a 4-ft. bed; the 6 in Battell, the 9 in Hacker's Creek, and the 9 in Lincoln are in a 7-ft. bed. About half of all the mines produced each 1,000 bush. or more. The coals are those of the Upper group, the *Pittsburg*, etc., and perhaps the *Upper Freeport* of the Lower group, as described in Dr. Stevenson's paper.

Gilmer County, of which Glenville is the county-town, is crossed and wholly drained by the Little Kanawha. During the 10th-Census year 33 coal mines were worked in this county for local use, 12 in DeKalb district in a 6-ft. bed, 11 in Sand Fork in an 8-ft. bed, and 10 in Steer Creek in a 4-ft. bed, all producing about 1,100 tons. The largest product, some 10,000 bush., was from M. H. Stump's mine near Glenville. The coals are those of the Upper Barren group, the "*Brownsville*," the Upper Coal group, the *Waynesburg*, the *Pittsburg*, etc., as described in Dr. Stevenson's paper.

Pleasants County, bordering on the Ohio, northwest of Parkersburg, had but one considerable mine worked, that of Wm. N. Caldwell, in a 2-ft. bed of semi-bituminous coal from which about 100,000 bushels were taken, by the labor of some 7 men, for use at the coal oil works on Bull creek in the southern part of the county. These mines can produce 150,000 bushels per year.

Lynchburg Iron, Steel and Mining Co.,

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Manufacturers of Bar and Loop Iron, Railroad Spikes, Fish Plates, and Bolts. Also, Machine Work of all descriptions. SPECIALTIES:-Blast Furnace and Rolling Mill Machinery, Hydraulic Cotton Screws, Mining Machinery and Bridge Work of all kinds. Office, 319 Walnut Street, Philadelphia.

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Mineral and Other Lands.

JUDICIAL SALE OF THE ARCADIA IRON WORKS PROPERTY.

As Special Commissioner of the Circuit Court of Botetourt county, Virginia, I will offer for sale at public auction, to the highest bidder, in front of the Exchange Hotel, in Buchanan, Virginia, at 12 M., on

WEDNESDAY, THE 10TH DAY OF AUGUST, 1881,

that VALUABLE MINERAL PROPERTY known as the ARCADIA IRON WORKS, including the SKIDMORE PLACE, formerly the property of Wm. W. Boyd, dec'd, and recently sold by me to Richard N. Pool, who assigned his purchase thereof to L. F. Beckwith, trustee.

This property is situated on the lines of the Richmond and Alleghany and Shenandoah Valley railroads, in Botetourt and Bedford counties, beginning near Buchanan and extending down James River about ten miles, covering about thirty-nine square miles, (the foot-hills and western slope of the Blue Ridge mountain,) and embracing about twenty thousand acres in fee simple and about four thousand acres additional of mineral rights.

Part of the land is valuable for cultivation. There are on it great bodies of fine timber suitable for charcoal, mine-timbers, ties, tan-bark, &c.

Its deposits of Iron-ore—Red Hematite (Specular), Brown Hematite (Limonite) and Magnetic—are very extensive and valuable. Some 20,000 tons of the Red Hematite ore may now be seen on the dumps at the different mines. There are also on the property Limestone, Slate, Manganese, and indications of Zinc.

The Hot blast Charcoal Furnace and out-buildings are in a good state of preservation. The water-power (Jennings creek) is ample for large operations. The property may be advantageously divided into three parts.

The sale will be with a reservation of the right of way through the property, granted by R N. Pool to the Shenandoah Valley Railroad Company, subject, however, to confirmation by the Circuit Court of Botetourt county.

TERMS OF SALE:—Cash in hand $39,000.00; as to $38,042.22 on a credit until October 4th, 1881; as to $38,042.22 on a credit until April 4th, 1882, and as to the residue, on a credit until April 4th, 1883, or at such other time on or after April 4th, 1882, as R. N. Pool, or L. F. Beckwith assignee and trustee for R. N. Pool, or either of them, may direct. For deferred payments bonds will be required, and the title will be retained until full payment.

Expectant purchasers are invited to inspect the property. For full description, analyses of ores, maps, &c., address the undersigned, or Walter N. Johnston, Esq., Buchanan, Botetourt county, Va.

JOHN W. JOHNSTON,
Buchanan, Va., June 25, 188 . Spl. Com r.

THE PAINT CREEK MINING Properties of Kanawha County, West Virginia.

PAINT CREEK MINING CO., (On west side of Paint Creek.) **10,000 acres.**

WACOMAH MINING CO., (Adjoining the lands of other Co., but mainly on the east of Paint Creek.) **4,700 acres.**

PAINT CREEK RAILROAD CO. (From mouth of Paint Creek up the same)

All under one management with same directors and same stockholders holding same ratio of interest in each company.

L. L. CONRAD, of Baltimore, ...President.
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DIRECTORS.

L. L. Conrad, of Baltimore.
Geo. W. Riggs, of Washington.
H. H. Parker, of New York.
John S. Barbour, of Alexandria, Pres't Va. Midland RR.
James F. Patton, of Union, Monroe Co, W. Va.
Wm H. Edwards, of Coalburg, Kanawha Co., W. Va., Pres't of Kanawha and Ohio Coal Co.
Isaac N. Smith, Charleston, Kanawha Co., W. Va.

Isaac N. Smith, of Charleston, Kan. Co., W. Va., ...Solicitor.
Oscar A. Veazey, of Paint Creek, Kan. Co., W. Va.,..Engineer.

These companies have been organized for the development of valuable coal loads owned by them. They are now constructing a first-class railway through the properties, having its terminus in the pool above Lock and Dam No 3, part of the improvements now being constructed by the U. S. Government on the Kanawha River. This railway will be completed and equipped for transportation of coal in September, 1881. It crosses the C. & O. Ry. and connects with it, so that shippers will have every facility for both river and railway trade.

The companies are prepared to make leases to reliable parties and to ship the coal of their lessees to river and rail upon most favorable terms.

Their Cannel, Splint, Bituminous and Coking Coals are unexcelled in quality, quantity and size of workable seams—the principal splint coal seam averaging ten feet.

Application for leases may be made to the President direct or through any of the Directors.

More particular information given upon request, by mail or otherwise, to L. L. Conrad, President, 15 Lexington street Baltimore, or Isaac N. Smith, Charleston, Kanawha county, W. Va., Solicitor of the Companies.

JAMES RIVER SPECULAR ORE PROPERTY FOR SALE.

We offer the fee simple in the MINERAL RIGHTS on 750 acres of land, immediately on the James River Canal and the Richmond & Alleghany RR. This property is situated a short distance below Riverville, in the heart of the magnetic and specular ore belt of the James River Valley It is one of the most valuable iron ore properties now on the market—the deposits being very large, and the ore of the purest quality Price $16,000.

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The undersigned, as President of a Land Company, has for sale or lease, on favorable terms, some of the best coal and timber lands in the New River District, on the line of the Chesapeake and Ohio Railway. The coals on these lands are the **Coking Coals**, the coke from which is now so much in demand for blast-furnace and other metallurgical uses. For further information and terms, apply to

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The undersigned, as agent for the owners, will lease on favorable terms a tract of 680 acres of coal on the Ohio river, at West Columbia, West Virginia, four miles below Pomeroy, Ohio. This tract adjoins the Camden Coal Mines, which are now in successful operation. Several entries to the coal have been opened, and mining can be begun with very little expense.

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I offer for sale the Residence of Mrs. Virginia B. Donaghe, fronting on three of the principal streets—Main, Lewis and Frederick—in immediate proximity to business, churches, schools, &c. The improvements are first-class, and the property one of the best, if not the very best in the city, either as a home or a speculative investment. It will be subdivided if not sold as a whole. Examination invited.

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I will sell or lease the "Hodge Gold Mine," in Burke Co., N. C. Placer mine and quartz vein recently found on it. See plat at office of THE VIRGINIAS, Staunton.

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The next session begins September 16th, 1880, and ends June 22d, 1881.

For other particulars apply to J. L. CAMPBELL, Jr.,
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Staunton, Virginia.

The Lumber Traffic of the C. & O. Ry., from which revenue was derived, for the first half of 1881, and for the corresponding period of 1880, in car-loads of 2,000-lbs. tons, compiled for THE VIRGINIAS, from official returns, by Mr. Wm. L. Rawson, Gen'l Agt. of C. & O. Ry Lumber Agency, was as follows:

Point of destination.	1880.	1881.
Jas River for exp't and Coastwise trade	1,040	1,136
Richmond	290	356
Gordonville & N'th via V. M. RR.	9	25
Char'ville & S'th " "	87	131
Staunton & West " Ohio Riv	104	144
Huntg'tn & West " " "	236	200
Intermediate points on C. & O. Ry	707	1,053
Totals	2 473	3,042

Increase of 1881 over 1880, in car-loads, 569.

The return does not include the very large amount of lumber that was transported for the Company's use; it only embraces that for which freight was paid, and therefore does not represent, by a large quantity, the lumber business of the railway.

The gain was one of over 23 per cent, and this was shared by all the points of destination except Huntington. The largest increase, one of 49 per cent, was in the trade to local stations, one indicative of improvement all along the line.

Mineral and Other Lands.

SALE OF

MOST VALUABLE REAL ESTATE AND IRON PROPERTY.

By virtue of a decree of Nelson Circuit Court, pronounced at September term, 1880, in the chancery cause of Robinson &c. vs Peters &c., the undersigned, as commissioners, will offer at public auction at New Market, in said Nelson county, on

TUESDAY, AUGUST 9TH, 1881,

at 12 M., the real estate of Dr. Frederick J. Peters, known as the "Sleepy Hollow" tract of land, about 3 miles below New Market, containing 1264½ acres. The said 1,264 acres is valuable mineral property, and is regarded by many as giving the strongest evidence of an unlimited quantity of iron ore, manganese, slate, marble and copper. The IRON ORE DEVELOPMENT here is regarded by scientists as the greatest in the James River Valley. Practical miners and geologists who have examined this property are of the opinion that nothing surpasses it in quantity of iron ore, unless it may be the Iron Mountain of Missouri.

About 300 acres are cleared and the remainder is in original growth. It lies within one mile of the R. & A. RR. This property is looked upon as the most valuable mineral property that has ever been offered in this section of Virginia, and all persons desiring to purchase, are invited to examine it. It will be sold ether in whole or in parts to suit bidders.

TERMS:—Cash enough will be required to pay costs of suit and sale, and for the residue, bond with good personal security with waiver of homestead exemption, bearing interest from day of sale, and payable within one, two and three years.

THOS. P. FITZPATRICK, J. L. S. KIRBY, RO. WHITEHEAD, } Lovingston, Nelson Co., Virginia.
JNO. H. McCUE, Staunton, Va.,
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For particulars, address, FRANCIS H. SMITH, Superintendent.

Newspapers.

THE "STAUNTON SPECTATOR,"
129 E. Main Street,
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The "SPECTATOR" is published every Tuesday morning, at Staunton, Augusta county, Virginia, and is the best advertising medium in the interior of the State.

The "Spectator" was the first paper established at this place, nearly a century ago, and it is now in its 57th volume, under its present title. Its list of subscribers is larger than that of any other paper west of the Blue Ridge, and is, therefore, the best advertising medium in the Valley of Virginia, or in West Virginia. Address "STAUNTON SPECTATOR," Staunton, Virginia.

Mining and Civil Engineers.

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Attorneys,—Virginia.

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SHEFFEY & BUMGARDNER,
Attorneys at Law,
Staunton, Virginia.

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Wm. A Hudson Wm. Patrick.
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Practice in the Courts of Augusta and adjoining counties. Land titles a specialty. Refer by permission to N. P. Catlett, Cashier Augusta National Bank; Thos. A. Bledsoe, Cashier, National Valley Bank.

Attorneys,—West Virginia.

THOMAS B. SWANN,
Attorney-at-Law,
Charleston Kanawha County W Va

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The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 8. } Staunton, Virginia, August, 1881. { Price 25 Cents.

The Virginias,

PUBLISHED MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor

At 346 E. Main St., Staunton, Va.

Terms, including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising, per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

Entered at Staunton, Va., Post-office, as second-class matter.

Rogers' Va. Geological Reports.—Persons having copies of these reports for 1836, 1837, 1838, 1839 or 1840, that they will sell at a fair price, can find a purchaser by addressing Jed. Hotchkiss, Staunton, Va.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors.), complete, with index and title page, will be sent, prepaid, to any address in the U. S., *on receipt of Three Dollars.*

The Industrial South is the name of a large, new weekly that Gen'l James McDonald, and Maj. Baker P. Lee recently began the publication of at Richmond, Va. Its sole aim is the industrial development of the South. Its editors are thoroughly capable men for the work they have undertaken; the five numbers that we now have in hand are full of first-rate matter just such as the people of the whole country now desire to have. Most cordially do we commend *The Industrial South* to those that would have a good weekly filled with reliable information about what is going on in the South at this time. Price $2 a year in advance.

Chemical Analyses are now required by almost, every purchaser of large quantities of iron or other ores, coals or cokes as a guarantee of their quality and adaptation to special purposes,—in fact ores are now mainly sold by the percentages of metal they contain, or, as the dealers say, at so much per unit. Nearly all purchasers of mineral lands demand analyses of the ores, coals, etc., upon properties offered for sale before bargaining for purchase, that they may be sure they will get the kind of ore, coal, etc., they are seeking for. Such analyses must be made by reliable men, or they will not be accepted as guides.—To all those needing careful and trustworthy analyses we wish to commend Messrs. Booth, Garrett, & Blair, of Philadelphia, who offer their services to the public through our advertising columns.

Timber Lands, on Guyandot river waters, Wyoming county, W. Va., are offered for sale by Wm. Heald, on page 127 of this issue.—We know that the region of the head-waters of the Guyandot is one of the best timbered parts of the great timber State of W. Va. The report of the Chief of Engineers of the U. S. for 1879, Vol. I, page 1,348, says of the Guyandot country:—"Some of the finest timber in the world has been found there, and there are still immense forests from which none of the timber has been cut. Large and valuable deposits of coal, iron, and other minerals have also been found." The General Government has already spent considerable sums in improving the Guyandot for the benefit of the lumbermen. The Report of the Chief of U. S. Engineers for 1880, the last issued, says: "It is proposed, with the funds appropriated for the fiscal year 1880–81, to continue present operations, extending them above Logan C. H., into Wyoming, and possibly McDowell county, with the view of improving, firstly, the raft navigation over the entire river." The Great Flat-Top coal-field, of which we write elsewhere, extends through the Guyandot mountain on the western slope of which are the lands offered for sale, a part of the James Welch, Feb. 11, 1797, patent of 90,000 acres.

Mica, in large quantities, is used for insulating purposes; the Edison Electric Light Co. has awarded a heavy contract for its supply, to a Colorado company, says the *Eng. and M. Journal.*

Personals, Geological, etc.

Mr. H. F. Reid, of Johns-Hopkins University, and *Mr. Massie*, of the University of Virginia, geological students that accompanied Prof. Fontaine during his recent explorations, have been geologizing along the Chesapeake & Ohio Ry, in the Valley, Apalachia and Trans-Apalachia, making independent observations, since Prof. F. disbanded his field party at Rockfish Gap of the Blue Ridge, about the first instant.

We have met these young gentlemen, geologically fully armed and equipped, several times during their westward progress, and were greatly pleased with their earnest zeal in the work (pastime they made it,) they had in hand, and with their intelligent comprehension of the structure of the country they were exploring.—They wrote us, from Ronceverte, Aug. 17, when on their way to the coal-fields, "We have had a very pleasant trip up to this time; we have examined the iron mines at Ferrol and Clifton Forge, and expect to stop at Low Moor on our way back. We have carefully examined all the rocks up to XI, with the exception of II, and are, we think, fairly familiar with them."

These young men, who are becoming geologists and mining engineers in the right way—by making original field observations, constructing sections, etc., find THE VIRGINIAS, with its numerous maps and sections, a valuable guide, we are pleased to know in their explorations.

Mr. N. Allen Stockton, practical chemist from Philadelphia, has opened an office in Lynchburg, Va., for assays of ores and minerals, especially iron ores. His references are good and we hope he may find an abundance of work in the prosperous mining centre where he has located. It is a good evidence of our mining prospects when experts find it to their interest to locate here.

Mr. M. M. Duncan has become the chemist to the Roane Iron Co., Chattanooga, Tenn., in place of Mr. Fred. P. Dewey, who has gone to a place in the National Museum, Washington, D. C.—Mr. Duncan continues the laboratory at Chattanooga, and to his card as Analytical Chemist we invite attention.

Mr. O. Barrett, Jr., C. E., of Pittsburg, is now at Saltville, Va., connected with a proposed railroad from the Norfolk & Western from that place to Kentucky.

Our President will live, all indications seem to declare at the time of this writing,—Tuesday, August 30th, 10 A. M.; thanks to a kind Providence. Sustained by a sublime and trusting faith, cheered by the presence of a heroic, faithful and hopeful wife, and encouraged by the prayers and hearty desires of fifty millions of his countrymen, and, as it were, of all the world besides, General Garfield has courageously held on to all the threads of life for eight-and-fifty days, and now, just as hope, even, was about to be given up, his strength comes again and he appears to have taken a new lease of life. No more welcome news ever went through the length and breadth of our common country.

The Big Lick News, of Roanoke, the junction of Shenandoah Valley & Norfolk & Western railways, has these items in its issue of August 27:—The corps of engineers who have been surveying a route from Roanoke into Franklin county, have been removed to the New River road, where the work is being rapidly pushed. The company desire to have this road completed as soon as possible, and have removed forces of hands from other roads to work upon it.—Messrs. Kefauver & Son, manufacturers, shipped several car-loads of dump-carts to New River, Monday, to be used on the New River railroad.

The Metallic Iron in European Ores,—*Iron*, a London periodical, has a table of the tons of iron ore, on an average, required to make a ton of iron; from that, it appears that in 1880, it required 2.70 tons in England, 2.38 in France, 2.38 in Germany, and 1.73 in Belgium.

The Metal and Mineral Traffic of the Chesapeake & Ohio Ry. for the first 6 months of 1880 and 1881.

By the courtesy of General Manager C. W. Smith, we have been furnished with data, compiled from the records of the Company by Auditor of Revenue Robert H. Fisher, from which we have prepared the following article on the metal and mineral traffic of the Chesapeake & Ohio Railway during the first six months of the years 1880 and 1881. The returns of the coal and coke traffic of this railway for these periods was given in our July, 1881, number. The quantities given are in tons of 2,000 pounds:

Iron Ore.—The movement of iron ore, by months, was as follows:

	1880	1881.
January	2,790	1,490
February	5,439	2,642
March	3,029	3,646
April,	4,119	6,386
May,	2,461	5,218
June	1,984	3,858
Total	19,822	23,240

The increase in 1881 over 1880, was 3,417 tons, or over 17 per cent. The movement of iron ore will be a constantly increasing one from the great deposits on or near the line of this railway in Virginia as its extensions, branches and connections are completed so the ore can be delivered without break of bulk to centres of consumption.

The stations from which these ores were shipped and those to which they were destined, and the quantity from and to each station were as follows:

Destination.	Origin.	Quantity. 1880.	1881
Quinnimont, W. Va.	Alleghany	15	1,158
	Bell Valley	157	10
	Callaghan	807	1,329
	Clifton Forge	2,887	954
	Covington	3,699	1,048
	Ferrol	10,035	4,323
	Kanawha Falls	.....	12
	Longdale	.....	70
	Low Moor	1,056	.....
	Va. Midland RR	70	.....
	Williamson	42	2,920
Ferrol, Va.	Bell Valley	.....	411
	Clifton Forge	.....	192
	Fishersville	.....	20
	Gordonsville	.....	593
	Longdale	.....	90
	Williamson	.....	640
Huntington, W. Va.	Alleghany	218	324
	Callaghan	11	.....
	Covington	22	.....
	Ferrol	.....	13
	Low Moor	.....	108
	Williamson	.....	52
	Va. Midland RR	229	742
Low Moor, Va.	Alleghany	.....	476
	Backbone	.....	714
	Callaghan	.....	4,431
	Covington	.....	102
	Longdale	.....	149
	Williamson	.....	2,379
Buffalo Gap, Va.	Afton	165	.....
	Waynesboro	142	.....
Jas. R. wharves, Richm'd, Va.	Tolersville	267	.....
		19,822	23,240

Pig Iron.—The movement of pig iron, by months, was as follows:

	1880.	1881.
January,	1,869	3,238
February	1,689	3,861
March	1,997	5,695
April	1,536	2,307
May	2,201	5,182
June	1,652	5,646
Total	10,944	25,929

The increase in the carriage of pig iron in 1881 over 1880 was 14,985 tons, or over 136 per cent; a good indication of the great development in the manufacture of pig iron that has been made on the line of this railway.

The stations from which this pig iron was shipped and to those which it was destined, and the tons from and to each station, naming the stations in the order of their location from east to west, and the furnaces from which the pig iron came, were as follows:

Origin.	Furnace.	Destination.	Quantity. 1880.	1881.
Tolersville, Va.,	Victoria.	Hunting'n, W. Va.	187	.....
Buffalo Gap, Va.	Buffalo Gap.	Richmond, Va.	.....	191
		Staunton, Va.	.....	28
		Hunting'n, W. Va.	46	.....
Ferrol, Va.	Grace.	Staunton, Va.	.....	12
		Hunting'n, W. Va.	.....	1,935
Longdale, Va, Lucy Selina, Nos 1&2		Jas. R. (Richmond)	.....	2,676
		Charleston, W. Va	.....	29
		Hunting'n, W. Va.	3,820	6,346
Jackson River, Va,	Callie.	Hunting'n, W. Va.	.....	1,244
Low Moor, Va.	Low Moor.	Jas. R. (Richmond)	.....	712
		Richmond, Va.	.....	2,188
		Staunton, Va.	.....	979
		Hunting'n, W. Va.	.....	6,174
Quinnimont, W. Va.	Quinnimont	Richmond, Va.	36	229
		Fredericksb'g, Va.	.....	54
		Staunton, Va.	8	.....
		Charleston, W. Va	41	.....
		Hunting'n, W. Va	5,259	3,658
Virginia Midland RR.		Hunting'n, W. Va	1,391	(bal)
Valley RR. of B. & O.		Richmond, Va.	255	276
		Total	10,944	25,929

The pig iron from the Va. Midland and Valley railroads probably came from furnaces in the Shenandoah Valley, as Liberty, Columbia and Shenandoah.

The movement was mainly to Western markets, Cincinnati, etc., *via* Huntington, but that Northward, *via* Jamas River wharves at Richmond, was quite respectable in quantity. That to Staunton was mainly for shipment by Valley RR. of Baltimore & Ohio westward, to Pittsburg, we believe.

Limestone.—The movement was of Greenbrier (No. XI) limestone from Fort Spring station, W. Va., 50 miles westward to Quinnimont furnace, W. Va.; and of Lower Helderberg (No. VI) limestone from Steele siding, Va., eastward 3¼ miles to Low Moor furnace, as follows:

	1880.	1881.
Fort Spring to Quinnimont	9,303	5,507
Steele (credited to Covington) to Low Moor	.....	3,310
Total	9,303	9,817

Most of the supply of limestone for Low Moor is drawn from its quarries near the furnace; all that for Quinnimont is from Fort Spring.

Manganese Ore.—The movement, by months, was as follows:

	1880.	1881.
January	305	76
February	289	131
March	300	117
April	239	202
May	327	29
June	377	....
Total	1,827	555

The decrease in 1881 was 1,882 tons, mainly in consequence of the opening of the Shenandoah Valley RR., which runs nearer the Crimora mines than the C. & O., and which took the traffic after May.

All the shipments in 1880 were from Waynesboro, Va., the product of the Crimora mines, northward; 1,680 tons by James River wharves, Richmond, and 157 tons by rail; those of 1881 were also northward by James R. wharves, 532 tons from Waynesboro and 23 tons from Pomeroy, Ohio, *via* Huntington.

Lead.—The tons movement was as follows:

	1880.	1881.
From Huntington, north *via* James R. wharves	837	324

This lead all came from the West and was not the product of the Virginias.

Copper Ore—The movement for the first half of 1880 was 263 tons; 69 in Feb., 82 in April, 56 in May, and 56 in June.—It was all shipped from Tolersville, Louisa county, Va., except 82 tons in April, that came from some point on the Ohio and was delivered to C. & O. at Huntington; that for the first half of 1881 was 28 tons, in March, from Tolersville,—a decrease of 235 tons.

Marble.—The marble moved was fancy, encrinal, from the Lower Helderberg (No. VI) rocks. It was sent from Una siding (but credited to Goshen,) Rockbridge county, Va., and from Craigs-

ville, points but 8 miles apart. The tons, etc. of the movement were as follows:

		1880.	1881.
Craigsville....	North *via* Staunton.....	65	107
	" " Richmond.....	268	.....
	West " Huntington.....	86	66
Una.....	North *via* Staunton.....	10	.....
	West " Huntington.....	36	.....
	Total.....	465	173

The Salt tonnage moved was as follows:

	1880.	1881.
Malden, W. Va., west and to C. & O. stations ...	520	1,448
Richmond and James R. wharves, west.....	1,491	1,400
Total.....	2,011	2,848

The salt from Malden was from the Kanawha Valley, W. Va., salines, all the remainder was foreign, and its introduction, fostered by low rates of freight, has almost ruined the production of salt on the Kanawha.—The quanties here given do not represent the production near Malden, for most of that goes to market westward by the Great Kanawha and the Ohio. The increase, 928 tons, or over 176 per cent in the movement of Kanawha salt is an agreeable feature of this statement; we hope it means a revival of salt-making on the Kanawha.

The Lime movement, mainly for local use along the railway, was as follows:

	1880.	1881.
From Va. Midland RR.....	39	38
From Fishersville, Va.....	199	259
From Fort Spring, W. Va.....	261	163
From Richmond and Staunton.....	298	668
Total.....	797	1,128

The increase in 1881 was 331 tons, or over 41 per cent, due, doubtless, to the increased activity in all operations, building houses, etc., included, that marks 1881.—The movement from Richmond and from the Va. Midland is no doubt, in part, hydraulic lime.

This trade is trifling to what it should be, for this railway has over 125 miles of its length in the Virginias in regions where almost every variety of limestone abounds and where cheap fuel can be had for its conversion into lime. For agricultural purposes alone, along its line, the demand ought now to require the movement of 100,000 tons.

Brick Paving for Streets.

GORDONSVILLE, VA., Aug. 3rd, 1881.

MAJOR JED. HOTCHKISS:—Some time ago I saw a statement in a newspaper to the effect that some of the streets in Charleston, Kanawha Co., W. Va.. were paved with *brick*, and a rather sneering criticism on the material with which the people of that good city were satisfied to pave their streets. As I happened to have seen this brick paving put down some ten years ago, I took occasion, on a recent visit to the place, to inquire about the durability and general service of it; also made a personal inspection. I find a universal expression of satisfaction with it, and my inspection showed it to be in apparently as perfect a condition as when first put down. I am informed that it has not had one dollar spent on it for repairs.

I take pleasure in enclosing a letter from Dr. J. P. Hale, giving the details of his experiment with this brick paving. You will see that the Dr. attributes the success of his experiment to four principal elements, the quality of the clay, machine pressure, the very hard burning of the brick, which, however, are not vitrified, and the manner in which they were put down.

In localities like Richmond and elsewhere, where good granite Belgian blocks are to be had, they are probably to be preferred to the best of brick; but in very many localities where excellent clay, free of sand, may be had, and where granite blocks are not to be had, good, hard-pressed and hard-burned brick will certainly be found to make a paving of the very best character for streets, far superior to blocks of any kind of wood, sandstone or limestone, or any other kind of material that I know of except the very best quality of granite.

Yours truly, M. A. MILLER.

CHARLESTON, W. VA., July 29, 1881.

M. A. MILLER, ESQ.,

Dear Sir:—In answer to your inquiry in regard to brick street-paving, I will give you the history of an experiment I made here in 1871, the results of which has been very satisfactory.

The point selected was Summers street, between Kanawha and Virginia streets. Summers street is 30 ft. wide between the curb-stones, and the block is about 400 ft. long.

The street after being graded and rounded up to the proper convexity, was laid with common sheeting-plank boiled in gas tar; upon this was spread 2½ to 3 inches of sand, and upon this the brick were laid on edge and zig-zag, a coating of sand was then spread over the surface so as to thoroughly fill the spaces between the bricks, and the pavement was done.

Summers street is the third most used and traveled street in the city. Yet, after ten years use, there is not a hole, rut, or lump in the pavement. It is apparently as sound and as smooth as the day it was put down, and *in the ten years it has not cost one cent for repairs.* Having lasted ten years without apparent injury, it would be hard to fix a limit to its durability.

It is a delightfully smooth and even pavement to ride or drive over, just rough enough to give secure footing for horses, and does not get slippery with ice in winter.

I kept an accurate record of the cost of the pavement, but regret that I have mislaid it and cannot now find it; the data are free and simple, however, and an estimate can readily be made for any locality.

The success of this pavement I consider due, almost entirely, to the *character of the brick.* They were made by Mr. Levi, a brick maker and builder of large experience, of a very tenaceous clay, almost entirely free from sand, by machinery under heavy pressure, and were burned extra hard. Mr Levi also superintended the laying of this pavement. I do not think that ordinary hand-made brick, from sandy clay and burned to the usual hardness of building brick would stand the test at all.

Very respectfully, yours &c.,

J. P. HALE.

Recent Sales of Virginia Iron Lands.

The Sleepy Hollow Iron lands, in Nelson county, Va., near James river and the Richmond & Alleghany RR., 3 miles below New Market, that were advertised for sale in THE VIRGINIAS, as we learn by letter from one of the commissioners of sale, were sold at public sale, August 9th, to Thomas Branch, a wealthy banker of Richmond, Va. Mr. Branch paid $23,200 for an undivided half of the estate, and Dr. F. J. Peters, the former owner, holds the other half, so the sale was really for $46,400, a moderate price for so large and valuable an estate, one so rich in iron ores. We have it from one of the commissioners of sale that the purchasers propose to at once expend $100,000 in the erection of a furnace, the construction of a short branch railway from the mines to the Richmond & Alleghany, etc.

It is gratifying to note that Virginia capital has embarked in this purchase and that iron is to be made there, close by the line of movement of West Virginia coke, and not in Pennsylvania whither most of the ore from the Piedmont-Midland part of the James valley has heretofore been chiefly sent.

The Arcadia Iron property, near Buchanan, Va., on Shenandoah Valley and Richmond & Alleghany railroads, which was advertised for sale in THE VIRGINIAS, was sold at private sale, to George M. Bartholomew, president of Charter Oak Life Insurance Co. of Hartford, Conn., as we learn by letter, and from the *Buchanan Democrat* of Aug. 12. We are not advised as to Mr. Bartholomew's intention, but presume, as he is an active business man, with ample means at command, that he will proceed to utilize this very extensive and valuable iron property, concerning which we have already published full details.

The Big Hill Iron Mines, concerning which we wrote in July, were not sold to Col. Skiles, as stated by the *Alleghany Tribune*, which we quoted. Col. S. had an "option to purchase," for which he paid a liberal bonus, but he failed to complete the purchase before his option expired, as we learn from one of the owners.

Salt Manufacture in 10th Census Year in the Virginias.—Bulletin No. 245 of the Census Office, by W. L. Rowland, Special Agent for the Chemical Industry, just issued, is a preliminary report upon the Salt Manufacture of the U. S.; from that we gather the following in reference to this industry in the Virginias.

Virginia produced (at Saltville we may add) during the census year, 425,895 bushels of salt, from subterranean brines, by artificial heat, by the kettle or pan process, about 1-20th of the salt made in the U. S. in that way.

West Virginia produced 2,679,438 bushels, from subterranean brines, by artificial heat, by the steam evaporation process; it produced about 1-6th of the salt made in the U. S. in that way.

The facts of salt production in the Virginias, during the 10th Census year, are embraced in the following summary:

	Va.	W. Va.
Number of establishments	1	10
Capital employed	$1,000,000	$909,500
Most hands employed at one time	76	840
Average number of men employed	76	702
Average number of youths employed	....	34
Wages paid during year	$14,219	$160,227
Number of wells in use	2	57
Average depth of wells in ft	262	1,043
Average strength of brine	86°	35¼°
Number of blocks or furnaces	4	16
Number of kettles in use	340	....
Aggregate capacity, in gallons	37,400	....
Number of pans in use	....	614
Aggregate capacity in gallons	....	215,588
Number of settlers	....	71
Aggregate capacity in gallons	....	1,576,512
Number of grainers	....	79
Aggregate capacity in gallons	....	1,133,909
Coal } Tons used	....	124,010
Coal } Value	....	$100,178
Wood } Cords used	12,000	162
Wood } Value	$36,000	$269
Value of all other materials	$3,000	$39,000
Value of all materials used	$39,000	$192,113
Salt } No. of bushels made	425,895	2,679,438
Salt } Value	$127,678	$380,369

A comparative statement, from the Census reports of 1860, 1870, and 1880, of the salt industry of the Virginias, is presented below:

	1860.	1870.	1880.
Number of establishments	14	20	11
Number of blocks or furnaces	.....	.....	20
Capital employed	$523,800	$1,631,300	$1,909,500
Wages paid	$148,464	$290,800	$174,446
Value of all material used	$166,204	$385,255	$231,113
Bushels of salt produced	2,076,513	4,635,813	3,105,333
Value of salt produced	$410,684	$1,508,855	$508,047

To bring the facts of the above statement down to figures for a comparison by the unit of production, we have calculated from them the value of wages, materials and capital for each bushel of salt made, in the same years, with the following results:

	1860.	1870.	1880.
Capital employed for each bush. made	$0.252	$0.352	$0.615
Material used " " " "	.080	.083	.074
Wages paid " " " "	.071	.063	.056
Value per bush. by returns made	.198	.325	.163

Buckingham Slate—A letter from Buckingham Co., Va., to the Lexington *Gazette*, speaks of the slate quarries operated by J. R. & E. R. Williams in that county, at which about 100 laborers, most of them Welsh, are employed. Of this slate, and the demand for it, this writer says, correctly as we know:

"The slate, which is superior for its strength and durability of color, is split and dressed at the quarries, and conveyed on wagons to Bremo, where may be daily seen cars loading with it from one or more of the following roads: Wilmington and Weldon, Penn. Central, Northern Central, Ches. & Ohio, and Baltimore & Ohio.

The Appraiser's building, at San Francisco, Market House at Houston, Texas, Chamber of Commerce building at Galveston, Music Hall and the Exposition Building at Cincinnati, Louisville Courier Journal building, Custom House at Nashville, Western Union Telegraph building, New York, besides many leading church edifices in that city and Brooklyn, have all been covered with Buckingham slates. The average amount of sales now reaches $5,000 per month, and the supply can hardly keep pace with the demand."

Iron Pyrites.—The *Iron Age*, of Aug. 25, has this item: Notwithstanding the fact that large deposits of iron pyrites are known to exist in Virginia and in other states in close proximity to tidewater, large quantities of cupriferous iron pyrites are about to be shipped to this country from Spain for the manufacture of sulphuric acid, at Bergen Point. It is difficult to see why American mines cannot compete with those of Rio Tinto.

Blast Furnaces along the C. & O. Ry.—At this time, August, 1881, the condition of blast-furnace operations along the Chesapeake & Ohio is, as near as we can learn, as follows:

Victoria, Louisa county, Va., is out of blast, and has been for a number of years.—*Buffalo Gap*, Augusta county, Va., has been out of blast all this year; it has some 350 tons of pig on hand; some repairs are being made and some mining of ore has been done; it is reported that it will soon go into blast again under a new organization. —*Grace*, of Pa. and Va. Iron and Coal Co., at Ferrol, Augusta Co., Va., continues in blast, making from 15 to 16 tons a day.—*Virginia Iron & Steel Association* is at work constructing its large furnaces, near Goshen, Rockbridge county, Va., and not at the site of the old California furnace, as it was intended,—a wise change of location, as it places the furnaces nearer the C. & O., and gives them a more abundant supply of water.—*Lucy Selina* furnaces Nos. 1 and 2, of Longdale Company, Alleghany Co., Va., are both in blast, making between 60 and 70 tons a day; in 9 months preceding July 1, they probably made about 17,000 tons of pig, nearly equaling the production of Low Moor in the same period.—*Callie*, Botetourt Co., Va., is out of blast, in consequence of a short supply of water.—*Low Moor*, Alleghany Co., Va., from the 253 day of present blast, July 3d, to the 294th day, Aug. 13th, inclusive, with about 58 hours of stoppages, made some 2,792 tons of pig, using about 6,781 tons of ore, 3,770 of coke and 3,881 of limestone; its output for the 294 days of blast has been nearly 20,137 tons,—roundly, it and Longdale have made in the past 10 months 40,000 tons of pig, or 10,000 more than was made in Virginia during 1880.—*Quinnimont*, Fayette Co., W. Va., is being well and rapidly relined and put in thorough condition and will go into blast again early in Sept.; a large stock is being accumulated.

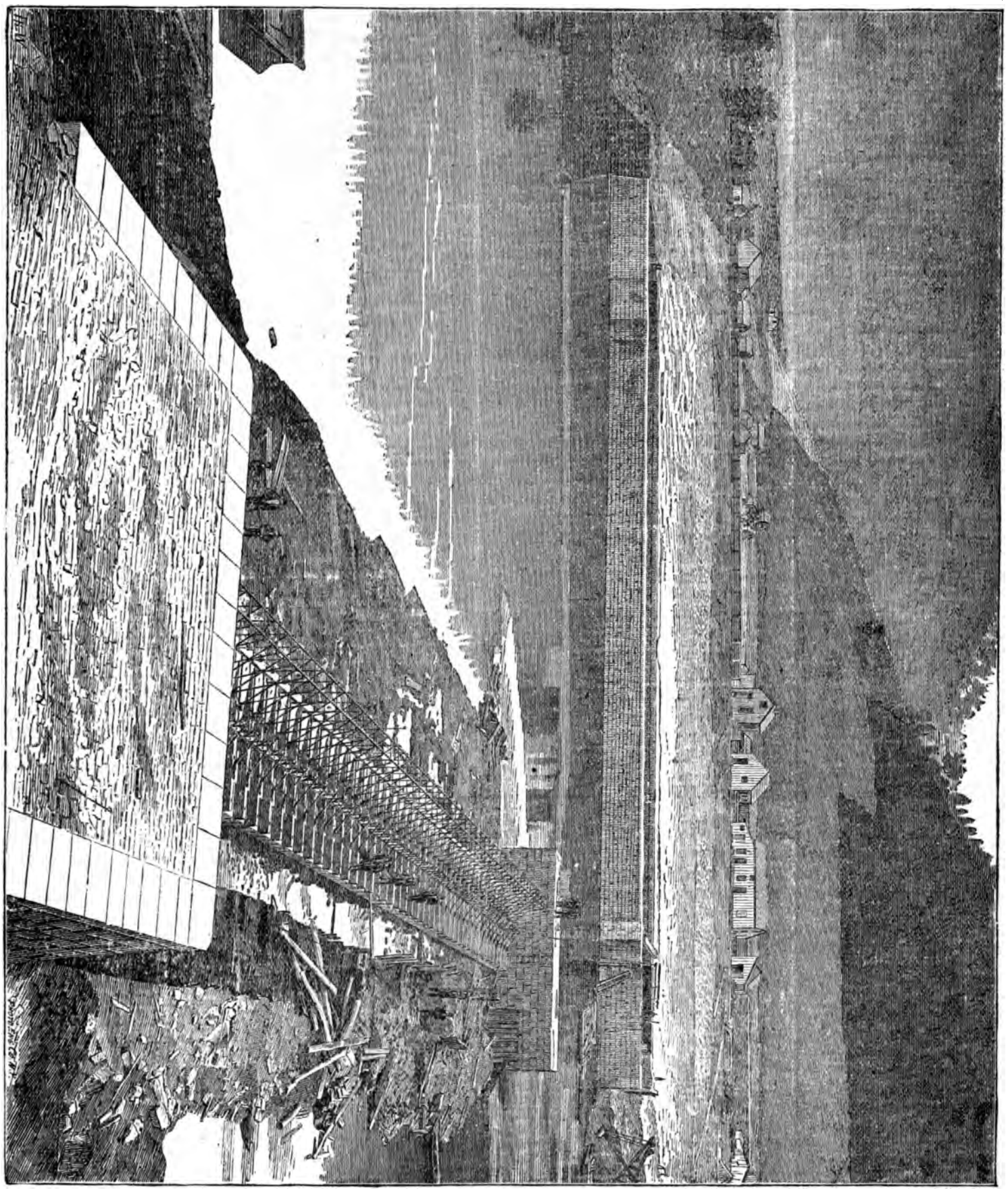
The Washing of Iron Ores.

LINDEN, WARREN CO., VA., Aug. 19, 1881.

FRIEND HOTCHKISS:—I am glad you made mention of "Iron Ore Washing" in your July number. I have of late visited many iron ore mines and find at every one of them a great waste—a throwing away in hematite ores. In the course of a few years these places will be called "worked-out", and will be abandoned until some one comes along with a new contrivance and washes all the "dump" over and makes it pay. Why not wash at once? Could not the evil, of which you speak, be overcome if each mining company would do here as is done in Pennsylvania, erect "mud dams," and allow the mud and water coming from the ore washing to enter these dams and stay there until the water is absorbed by the ground, leaving the mud as good arable land. In many places this waste mud is lead through troughs for a long distance and used by farmers or others for raising the surface of low lands, or for filling up old workings. By all means keep it out of the creeks. These dams are very easily built; the troughs are made from the washer to the centre or side of the dam. If, in a few days running, the ore is comparatively clean of mud, and the dam has too much water, tap it in the night and all trouble is over. Mud dams need not be over 4 or 5 feet high; they must be looked after daily. I am sure it is better to have this trouble at one's own door, than to be lawing and quarrelling with one's neighbor for years. Any mine can work a few years to raise ten acres a few feet, and I believe this is the only way to settle this question. JOHN C. KARSTEN.

The Coal River RR., the one having a charter with powers and privileges greater than can now be obtained by any new company from West Virginia, is one of the projected railways that, by a concurrence of circumstances, is sure to be built in the near future. It is chartered to go up Coal river and its branches from the mouth of that river at the Great Kanawha, at St. Albans station of the C. & O. Ry., and it may go thence to the Virginia line in almost any direction.—Our attention is called to this railway just now by the fact that it is in the direct line for an extension of the Flat-Top coal-field branch of the Norfolk & Western, now in process of construction, to the Ohio at the mouth of the Great Kanawha. Such an extension would be a paying one.

New River RR. Co., through its chief engineer, Pearisburg, Va., advertises in the *Engineering and Mining Journrl*, as "wanted immediately" a competent man to open and take charge of coal mines, construct and take charge of coke ovens, etc.; also, for a first-class man to superintend iron mining, shafting, tunneling, etc.—We suppose this means a prompt prosecution of mining in iron ores in Giles county, Va., and in coal in the Flat Top region of Mercer county, W. Va., and active preparations for coke-making on the Bluestone.



Lock and Dam No. 5, near Brownstown, W. Va., of Great Kanawha River Improvement. View from Abutment Bank.

The above view, from the report of the Chief of Engineers, U. S. Army, for 1880, shows the weir trestle bridge raised ; the horses and props of the weir wickets in place, but without the wicket frames. The coffer dam of the weir is not wholly removed. Next to the lock a portion of the pass trestle bridge is raised ; the other trestles and iron work are lowered. The pass is complete, except the placing of the wickets. The dimensions are : pass, 250 ft. wide ; weir, 265.42 ft. long ; movable portion, 5 ft. high ; lock, 300 ft. by 50 ft. in the clear ; lift of lock, 7 ft. This lock and dam, 5½ miles above Charleston ferry, are completed and now in use. This view shows the frame-work, as it were, of one of these movable dams, a dam just before completion, with an empty pool above it, while the view we published in July, shows a completed dam, with a full pool above it.

The Metal and Mineral Traffic of Norfolk & Western RR. for First Half of 1881.

Auditor E. E. Portlock has kindly furnished THE VIRGINIAS the data, compiled from the books of the company, from which the following statements, concerning the Metal and Mineral Traffic of the Norfolk & Western RR., for the 6 months ending June 30, 1881, have been prepared.—The quantities given are in tons of 2,000 pounds.

The Iron Ore movement was from Ironville, (credited to Buford station), Bedford county, Va., and from Cochneour siding, near Lynchburg, Campbell county, Va. The tons moved were 5,115, of which 4,038 went to Lynchburg, 11 to Norfolk, and 1,066 eastward *via* City Point.

The Pig Iron carried was 6,242 tons; 48 to Boston, 269 to New York, 1,840 to Philadelphia, 1,660 to Baltimore, 59 to Lynchburg, 32 to way stations, 1,441 to Richmond, 69 to Richmond & Danville RR., 112 to City Point for shipment, 647 to Southern states, 54 to Petersburg, and 11 to Va. Midland RR. It was shipped from Rural Retreat, Crocketts, Max Meadows, Martins, Dublin, Christianburg and Lynchburg.

The movement by months, was 1,047 tons in Jan., 757 in Feb., 940 in March, 837 in April, 976 in May, and 1,685 in June.

Zinc Ore was carried from Max Meadows, obtained from the mines near New River, in Wythe county, Va.; 1,080 tons in quantity, of which 1,056 went to New York, 11 to Baltimore, and 13 to way stations. The movement was 624 tons in Jan., 263 in Feb., 180 in March, and 13 in May.

The Zinc Spelter movement was 205 tons; 171 to New York, 23 to Philadelphia, and 11 to Baltimore. It was all taken from Martins, Pulaski county, Va., and was produced by the Bertha Zinc Works.

Coal was carried from Martins and Christianburg, to the amount of 2,806 tons; of which, 68 went to Lynchburg and 2,738 to way stations. The movement was 679 tons in Jan., 599 in Feb., 511 in March, 332 in April, 328 in May, and 357 in June.

The Salt movement, all from Saltville, at the end of a branch of the N. &. W., in Smyth-Washington counties, Va., was 1,705 tons, of which 245 were to way stations, and 1,460 to Southern states.

Lead Ore, 10 tons, was carried from Max Meadows to New York.

The Pig Lead moved was 36 tons; 32 to Boston and 4 to Southern states; it was carried from Max Meadows.

Of Copper Ingots, 94 tons were taken from Marion to New York. These came from the Ore Knob mines and works in N. C.

The Barytes movement was 2,152 tons from Marion, Wytheville and Lynchburg; of which Boston received 77, New York, 1,133, Philadelphia 816, Baltimore 37, Richmond 4, and Southern states 85 tons. By months, the traffic was, 359 tons in Jan., 228 in Feb., 378 in March, 325 in April, 455 in May, and 407 in June.

The Plaster traffic, all from the Holston beds at Saltville, was 3,982 tons; 1,759 tons to way stations, 25 to Richmond & Danville RR., and 2,198 to Southern states. The monthly movement was 91 tons in Jan., 547 in Feb., 1,618 in March, 1,280 in April, 400 in May, and 46 in June.

Of Limestone, 2,263 tons were moved from Ironville, Bedford county, Va.,—Valley or No. II limestone, though from Piedmont—2,253 tons to Lynchburg, for use in iron making there, and 10 to Richmond & Danville RR.

The Manganese carried was 236 tons to Norfolk, for export, from Cochenour siding, near Lynchburg.

The Marble traffic was 7 tons, from Wythebille; 4 to way stations and 3 to Southern states.

The total movement of metals and minerals for the 6 months was 25,933 tons; 157 to Boston, 2,733 to New York, 2,679 to Philadelphia, 1,719 to Baltimore, 6,418 to Lynchburg, 4,791 to way stations, 247 to Norfolk, 1,445 to Richmond, 104 to Richmond and Danville RR., 1,178 to City Point for outside lines, 4,397 to Southern states, 54 to Petersburg, and 11 to Va. Midland RR.

The monthly movement was 4,415 tons in Jan., 4,392 in Feb., 4,912 in March, 4,579 in April, 3,838 in May, and 3,797 in June.

From beyond Virginia, all from beyond Bristol except the copper, ingots, the traffic was 2,922 tons; 94 of *copper ingots* from Ore Knob, N. C., shipped from Marion to New York, 199 of *coal*, 140 of *pig iron*, 1,490 of *marble*, 732 of *manganese*, 103 of *zinc spelter*, 137 of *zinc ore*, 11 of *pig lead*, 5 of *lead ore*, and 11 of *barytes*. Most of these articles doubtless came from the Great Valley in East Tennessee.

When the Bristol and Imboden railway is completed, we shall expect to note a large movement of "Tennessee" marble from Estillville, Scott county, Va, on its line, where that variety of marble is abundant. The monthly returns show a steady increase in its carriage; in Jan. it was 203 tons, and in June 343.

The entire metal and and mineral traffic of this road for the first 6 months of 1881, was 28,761 tons.

A comparative statement of the metal and mineral traffic of the Norfolk & Western RR. for the last six months of 1880 and the first 6 of 1881, is given in the following table, in tons of 2,000 pounds.

	From Virginia.		From So. States.	
	1880.	1881.	1880.	1881
Iron Ore	214	5,115	....	....
Pig Iron	4,356	6,242	227	140
Lead Ore	1	10	....	5
Pig Lead	336	36	25	11
Zinc Ore	119	1,080	216	137
Zinc Spelter,	70	205	....	103
Barytes,	1,142	2,152	92	11
Plaster,	241	3,982	....	....
Limestone,	....	2,263	....	....
Marble,	....	7	2,093	1,490
Manganese	16	236	1,280	732
Salt,	4,722	1,705	....	....
Coal,	5,174	2,806	1,668	199
Copper Ingots,	....	....	185	99
Totals,	16,391	25,933	5,786	2,927

The total tonnage for the last six months of 1880, was 22,177 tons; that for the first six months of 1881, the succeeding ones, was 28,860,—an increase of 6,683 tons, or over 30 per cent.

The increase in traffic from Virginia mines, furnaces etc., was 9,542 tons, or over 58 per cent; an exceedingly handsome one under any circumstances, but especially so when we consider that there is always a large decrease in salt and coal tonnage the first half of the year, though this is partly balanced by the increase in the plaster movement, incident to that period.

The suggestive features of this statement for Virginia are: the very great increase of nearly 230 per cent in the movement of iron ore, in consequence of the opening of mines at Ironville and the manufacture of iron at Lynchburg; the gain of over 43 per cent in pig iron traffic, showing the activity and development in iron manufacture in S. W. Va. and at Lynchburg; the increase in shipment of zinc ore, spelter, barytes, and manganese; and the new traffic in limestone, for blast furnace use at Lynchburg, that amounted to 1-12th of the whole tonnage.

The falling off in the traffic from states beyond Virginia, is a very marked one in all the articles. It is probably due to a diversion to other lines of transportation and to the opening of other ways to market, such as the Cincinnati Southern RR., and not to a diminution of production. The spelter movement is a new one, zinc furnaces having lately gone into blast at Mossy Creek in E. Tennessee.

Recent Sales of Coal Lands in W. Va.—Theodore Wright, of Philadelphia, Pa., recently purchased, for $120,000, the large "Winifrede" tract of coal land, located mainly on Fields' creek of the Great Kanawha, and near the Chesapeake& Ohio Ry., 12 miles above Charleston and 4 below Coalburg. This land was sold under a decree of the U. S. Court, and there was a spirited competition for its ownership.—This is a very valuable coal property, one favorably situated in the Great Kanawha field, and from which a highly esteemed coal was formerly shipped. We learn, from a reliable correspondent, that Mr. Wright expects to develop the coal mines of this purchase immediately.

The Lumber Traffic of the Norfolk & Western RR.

From data compiled by the courtesy of Col. E. E. Portlock, Auditor, from the books of the Norfolk & Western RR., we are enabled to prepare the following statement of the lumber traffic of that road for the 6 months ending June 30th, 1881.—The quantities given are in 2,000 lbs. tons. We regret that the kinds of timber are not given.

The movement of Virginia lumber and its destination were as follows:

Destination.	Lumber.	Logs.	Staves	Wood.	Total tons.
Boston.....	166	262	.....	24	452
New York,.....	512	1,891	.. ..	..	2,403
Philadelphia,....	23	306	.....	..	329
Baltimore, ...	12	446	.....	..	458
Norfolk,.....	3,423	190	733	30	4,376
City Point, (for outside)	190	282	..	160	632
Petersburg,.....	2,949	147	18	3,277	6,391
Richmond,.....	1,544	19	19	....	1,582
Lynchburg, ...	951	.....	....	95	1,046
Va. Midland R. R.	143	747	....	....	890
Way stations, ...	1,624	70	...	2,153	3,847
Aggregate tons,..	11,537	4,360	770	5,739	22,406
Beyond Bristol,..	3,648	2,364	1,270	.....	7,282
Tons moved,....	15,185	6,724	2,040	5,739	29,688

The monthly movement of Virginia lumber was as follows:

Months.	Lumber.	Logs.	Staves.	Wood.	Total.
January,.....	1,186	389	46	808	2,429
February,.....	1,500	667	145	1,150	3,462
March,.....	2,139	634	113	972	3,858
April,.....	1,765	428	195	832	3,220
May,.....	2,427	972	184	688	4,271
June,.....	2,520	1,270	87	1,289	5,166
Total.....	11,537	4,360	770	5,739	22,406

This shows a steady growth in this traffic, especially in sawed lumber and logs. The lumber business of this road will be greatly increased as soon as its New River branch is completed to the great Flat Top mountain; for Mercer county, W. Va., and the plateau counties beyond are largely covered by forests of superb timber of many varieties, especially oaks, poplar and chestnut, and with large areas of pines and hemlock. The country between Mercer and the main line is also rich in timber. The road from Imboden to Bristol will also become a lumber feeder.

The monthly movement from beyond Bristol was also a steadily increasing one.

Exhibition of Minerals and Woods by the Chesapeake and Ohio Ry. Co.—We have received from Capt. Henry C. Lee, Special Agent of C. &. O. Ry. Co., the following circular. We would urge all those having minerals and timber, to aid this important work by contributing specimens.

"It is the intention of the Chesapeake & Ohio Ry. Co., to place on exhibition at Yorktown, at the Va. State Fair, and at the Virginia Industrial Exposition, in Richmond, specimens of minerals of all description, from the line of their railway.—These specimens will be labeled with the name of the exhibitor and exhibited free.

The company also intends to exhibit samples of the different woods from along its line, such as the mills now operating there can furnish. These specimens will also be labeled with the exhibitor's name, and shown free.

Parties having such minerals or woods, and wishing to place them on exhibition, will please foward them, at once, to Henry C. Lee, Special Apent C. &. O. Ry., Richmond, Va. Agents are instructed to send them free of charge, In sending specimens, please label neatly, or give full information so they can be labeled at this office."

Coppee Coke Ovens, such as the Hawks-nest Coal Co. proposes to build for making coke for the very large blast-furnaces the Virginia Iron & Steel Association is now erecting near Goshen, Va., on the C. & O. Ry, are now gaining great favor in England, as we learn from our exchanges. The Dowlais company has 72 such now in use and the Rhymney company is putting up a plant of this form.

The Crescent Coal Mines of Capt. W. R. Johnson, on the Great Kanawha, Crescent station, of the Chesapeake & Ohio Ry., 78 miles east from Huntington, sent to market about 80,000 tons of "Kanawha coal" in 1880,—the largest output, so far as we know, of any mines on the C. & O. The output for the first 6 months of 1881 has been about 50,000 tons from the three Crescent mines that are now in operation; so we may look for 100,000 tons from the "Crescenting" operations this year.—The Great Kanawha coal field has a well-assured future, one that will soon become a present reality when it has a hundred mines producing as the Crescent, and others we will mention hereafter, now do.

The Norfolk & Western and Shenandoah Valley Railroads.—Editorial.

(Continued from June No., page 89, in which is an illustrative map.)

Geological and Mineralogical.—An inspection of Rogers' Geological map of the Virginias (published in our June, 1880, number, shows that nearly every geological formation known to be in North America, from the Archaean at the base to the Quaternary at the top of the geological column, is now or soon will be either crossed, traversed or reached by this railway and its branches in Virginia and West Virginia,—a statement that necessarily, in these states, carries with it another, as a consequent; namely: that every variety of mineral wealth that pertains to any of these formations, where they are fully developed, as all informed geologists know and concede they are in Virginia, exists abundantly in the country tributary to this railway. (For table of Virginia and West Virginia geological formations and equivalents, see page 14 of THE VIRGINIAS for 1880.)

The geological formations exposed on and near this railway and its branches, taking them in the topographical order of their appearance from the Atlantic to the westward—summarizing the more important economic minerals found in each, are as follows:

(1) The Quaternary, the more or less modified surface of the country generally, the last made of the formations, appears everywhere, but especially in the Tidewater region.—Beds of glass, molding and building sands, of brick and terra-cotta clays, of ochres, and of shells are found in it.

(2) The Tertiary sands, gravels, marls, clays, etc., underlie the surface and crop out in the banks of the streams and ravines, all the way from Norfolk to Petersburg; the Pliocence, or Upper and later Tertiary, in the Eastern marine plain, and the Miocene, or Middle, and the Eocene, or Lower chiefly in the Western.—Green-sand, shell and other agricultural marls, and sands and clays of various kinds abound in this formation.

(3) The Archaean rocks—the basal ones, those generally conceded to be the oldest or first formed of all—are the exposed ones, except for a very short distance, all the way from Petersburg to Thaxton, 153 miles, entirely across Midland and Piedmont. From Thaxton to the Tennessee line the western outcrop of these rocks forms the Eastern Blue Ridge and the Blue Ridge plateau, which are but a few miles to the eastward from the Norfolk & Western. These in the Blue Ridge occupy the same relations to the Shenandoah Valley RR. for its whole length.

Rogers is inclined to the opinion that the exposures of these rocks from Petersburg to near Wellville are Montalban, or upper Archaean; those thence to near Appomattox Laurentian, or lower Archaean; those at Lynchburg and vicinity Huronian, or middle Archaean; and those at Forest, Liberty, and vicinity, Laurentian again.—Almost numberless forms of schists, shales, slates, sandstones, granite and other rocks, appear, in almost endless repetitions, in every cut and eroded surface between the head-of-tide and the Western Blue Ridge.

Among the Archaean rocks are found the best of granites for all purposes, like the fine-grained and pleasant colored gneissoid ones at Petersburg, and like the bed at Buckingham C. H., which Dr. J. C. Southall, of the *Central Presbyterian*, of Richmond, Va., says "is more beautiful than the Richmond granite, and equal to the finest in the United States." The best roofing slates known (a statement warranted by the demand for them in all parts of the Union and also in Europe) form a member of this group of rocks in Buckingham, a county on the line of this railway. Iron ores, magnetites, speculars and limonites, abound here, as in the Lake Superior region, in the Huronian members of the Archaean, and some of the belts of these are accompanied by outcrops of good limestones. Gold, copper, lead, manganese, steatite or soapstone, barytes, mica, plumbago, fire and china clays, ochres, and several other valuable minerals are found, in quantities to make the working of them profitable, exposed naturally or by workings, in one part or another of the 327 miles stretch of Archaean country tributary to the Norfolk & Western and the 230 tributary to the Shenandoah Valley in the Virginias.

(4.) Jurasso-Cretaceous, or Upper Mesozoic rocks, the Upper Secondary sandstones of the Virginia survey, resting, according to Rogers, on Montalban gneiss, are touched at Petersburg, from near which a small area of this formation extends along the north bank of the Appomattox, nearly to its mouth. At Farmville, and for a few miles beyond, the southern part of an oval area of Jurasso-Triassic, or Middle Secondary sandstones, containing beds of indifferent coal, is crossed by the railway. Not far from Petersburg lies the large area of these rocks from which the well known and much esteemed Chesterfield coal has been mined in large quantities, and southward from Spout Spring begins a long strip of this formation that extends west of south into North Carolina.—The Mesozoic rocks in Virginia are in several detached areas, islands as it were, in the Archaean country; they contain beds of coal, extensive and valauble only in the Chesterfield basin, and good building stones.

(5.) The Lower Cambrian rocks, those of the Potsdam group, Rogers' formation No. I., or Primal,- the hard, white sand-rocks, the shales, etc., that make the Western Blue Ridge and, more or less, its slopes, appear and are crossed between Buford and Blue Ridge stations, and thence southward to the Tennessee line and northeast to the Potomac, a distance of more than 300 miles, these rocks are seen, eastward from the line of the Norfolk & Western and the Shenandoah Valley railways, in and sustaining the broken and irregular western ranges of the Blue Ridge chain, its sand-rocks outcropping in some places as bold, ragged, and ghastly-looking cliffs, and in others shingling the mountain sides with broken masses. It may be found that these rocks outcrop in a portion of the Draper mountain range, and some other of the detached ones of the southwestern part of the Valley.—This group of rocks is famous for the quantity of iron ores that accompanies it, specular ones among its lower members and brown hematites among its upper ones. The natural displays of these ores along and near these railways, as near the Shenandoah Iron-works in Page and Rockingham, near Vesuvius in Rockbridge, near Buchanan in Botetourt, near Ironville in Bedford, near Radford in Pulaski, and, in fact, all along the outcrops of this formation, are among the most extensive and valuable known,—really but few know how extensive they are, and how valuable they will become when once developed. The best of glass-sands, from the waste of Potsdam white sandstones, make hillocks all along the Primordial foot-hills of the Western Blue Ridge; and building stones, especially those good for blast-furnace construction, equally abound.

(6.) The Middle and Upper Cambrian rocks, the Lower Silurian of some writers, Rogers' formations No. II (the Calciferous, Levis and Chazy rock-groups of N. Y.), and No. III (the Trenton, Utica, and Hudson River formations of N. Y.), the various and varied limestones, shales, slates, etc., that characterize the Great Valley, underlie the country and outcrop immediately along the Norfolk and Western for most of the 167 miles from Buford to Bristol, and along the Shenandoah Valley from Roanoke to Hagerstown,—the limestones of the upper II, Chazy, and those of the lower III, Trenton, generally underlying what may be called the Valley proper, or plain portions of the Great Valley, and the slates, shales, etc., of middle and upper III, the Utica and the Hudson River rocks, underlying the more broken portions of the Valley and making the conspicuous rugged spurs that flank some of the detached central ridges. as in Lick mountain, along the western side of which runs the Norfolk & Western in Wythe county.—In these formations (which underlie the exuberantly fertile surface of over 4,000 square miles of the Great Valley that these united railways traverse with 400 miles of their length) abound, in quantities sufficient for any demand—dolomitic limestones, such as are used for basic bricks, hydraulic limestones for cement (worked for this purpose at Shepherdstown, and more largely at Balcony Falls, by the Messrs. Locher, on the line of these roads); highly calcareous limestones from which the best of lime for agricultural, architectural, and glass-making purposes can be made, (such as is now made at Riverton, Rockdale, Indian Rock, and elsewhere along these railways,) and presenting every variety needed for blast-furnace fluxes; gray and blue limestones, and marble of several kinds, for building purposes; calcareous marls, good for flux in iron-making and for land fertilizing; the best of clays for brick-making; beds of flint suitable for the fire-brick maker's use; extensive deposits of the very best of iron ores, all along the Valley, but especially in the southwest where they supply the car-wheel iron making furnaces of that region; those named elsewhere in this number, from which the Virginia iron carried by the Norfolk & Western is obtained; extensive deposits of lead and zinc, such as are worked at the Bertha, Falling Cliff, Austinville, Brown Hill and other mines in Wythe, from some of which come the ores for the Bertha Zinc Works, at Martin station, and at the hundred-years-old Wythe Lead works; and baryta is mined at many places, as our report of N. & W. mineral traffic shows.

(6.) Rocks of the Silurian group (Upper Silurian of some)—the Medina sandstones, etc., No. IV; the Clinton sandstones, iron ore bearing shales, etc., No. V.; the Lower Helderberg limestones, including the encrinal marble bed, No. VI; and the Oriskany sandstones, iron ore bearing shales, etc., No. VII.,—outcrop, more or less, in most of the parallel Apalachian ranges that lie along the Great Valley on its western side, and most of the detached Valley ranges of the same mountain system, as the Massanutton, Mills, Lick, etc., ranges that bound the horizon, of the traveler on these railways, for most of the way, from Hagerstown to Bristol. The Medina white sand-rock (Oneida conglomerate of some) cornices the Massanutton and Lick ranges, and attracts and fixes the attention by its dazzling whiteness and the weird contrast it makes with the dark slates of III that underlie it, and with the dark foliage of pines and oaks that adorn its crevices.—The red shale and fossil iron ores of the Clinton, No. V, abound, the former, in a bed not less than 30 feet thick, in the 50 miles of the Massanutton mountains just west of the Shenandoah Valley road in Warren, Page and Rockingham, (a bed that supplies Catherine furnace, westward from Grove Hill station, that Pennsylvania iron-masters have recently leased for working); the same ores abound in the Short Hills and Purgatory mountains of Rockbridge and Botetourt, convenient to the line of the Shenandoah Valley road, and the same ores, in the Apalachian region farther southwest, will come to the Norfolk & Western by the New River, the Saltville extension and the Bristol and Imboden branch roads that penetrate the Apalachian country. The Lower Helderberg, No. VI outcrops with the Clinton and furnishes an excellent limestone for blast-furnace flux, the one now used by the large furnaces on the C. & O. Ry, in Va.; in the same formation is the encrinal marble that is now an article of trade from Virginia. The Oriskany, No. VII, in almost all cases, carries with it thick stratified beds of iron ore (those from which Longdale and Low Moor, the great furnaces of Va., now in operation, draw their supplies), some of which, accessible by the New River RR. of Norfolk & Western, like those of Craig Creek mountain, of which we gave analyses in our last, are ores of a high grade.

(7.) The Devonian rocks, the greatly varied shales, slates, sandstones etc., of No. VIII (the group including the Marcellus, Hamilton, Genesse, Portage, and Chemung formations of New York), and the massive sandstones and variegated shales of No. IX (the Catskill rocks of New York), are very conspicuous in the foot-hills and on the flanks of the Fort Lewis group of mountains in Roanoke and Montgomery, and in the broken ridges near Martin, near these railways, and in the more distant, but visible, Brush, Brushy, and other ranges more to the northwest.—These rocks, so far as known, contain, in Virginia, no ores or other minerals of much value; chalybeate, sulphur and alum springs flow from VIII in many places, some of them much frequented in the "springs season;" and some very good building stones may be had from No. X.

(8.) The Lower Carboniferous rocks, (Lower Sub-Carboniferous of some), the Montgomery grits and coal measures. No. X, and the Middle Carboniferous rocks, No. XI, Greenbrier limestones below and shales above, are seen, the limestones in the narrow valleys and the sandrocks, or grits, and their coals in the bold broken ranges on the westward side of the valley in detached areas from Roanoke to Bristol.—The coal beds of No. X, the Lowest Va. coal measures, in Botetourt, Montgomery, Pulaski and Wythe counties have a considerable local value, as the traffic returns of the N. & W. show, especially those near Martin, in Pulaski, from which supplies are drawn for the zinc furnaces at that station and for some of the salt furnaces at Saltville, the latter using at this time about 50 tons a day. (What the future of the coals of these much broken and crushed measures may be, when the cheaply mined and good coking coals of Flat-Top and Imboden become available, it is difficult to foretell; now they are successfully used, as above stated, at about half the cost of wood at Saltville, and also for domestic and blacksmith purposes at numerous points on the N. & W. not far from the mines.)

The No. XI limestones furnish good materials for masonry and buildings and for lime-burning, and pockets of iron ore are found among them In No. XI Rogers locates the plaster (gypsum) and rock-salt beds of the Holston valley, that are reached by the Saltville branch of the N. & W.; the 1880 census returns, which we publish elsewhere, put the quantity of salt made at Saltville in that year as 425,895 bushels, and Boyd, in his Resources of S. W. Va. makes the annual output of plaster in that valley about 6,300 tons; quantities that in both these articles, could easily be very largely increased.

(9.) The Upper Carboniferous rocks, the Middle and Upper Coal Measures, the true coal measures here, formations XII to XV, outcrop, in the eastern escarpment of Trans-Apalachia, before described as the extension of the Cumberland mountain, at from 20 to 40 miles, air-line distance, an average one of 30, to the westward from the 106 miles of the Norfolk & Western between New River and Bristol stations. This escarpment, in which numerous beds of coal outcrop to the eastward, above the water-levels of the country, will

soon be reached by branch roads, now in process of construction, from the Norfolk & Western.

In his Notes on the Geology of Wise, Lee, and Scott counties, Va., (published in THE VIRGINIAS, Feb., 1881), Prof. J. J. Stevenson enumerates 5 workable beds of coal in the Middle (XIII) measures that will be reached near Imboden by the branch railway from Bristol. These beds from below up, are: the "Imboden," 8 ft. thick; the "Kelley" that was seen 15 ft. thick; the "Lower Splint," from 3½ to 4½ ft. thick; the "Upper Splint" 3½ ft. thick; and the "Cannel," 7¼ ft. thick. In the Lower measures (XII) there are probably 2 workable beds in that region. The character of these coals, aggregating over 45 ft. of thickness, is given in the following analyses by A. S. McCreath, the chemist of the Geological Survey of Pennsylvania:

	(1.)	(2.)	(3.)
Water at 225°	0.880	1.610	1.380
Volatile matter	37.580	38.850	35.920
Fixed carbon	58.059	57.879	60.591
Sulphur	0.406	0.771	0.594
Ash	3.075	0.890	1.515

(1.) Is of coal from "Upper Splint" seam; (2.) is from the "Kelley" seam: and (3.) is from the "Imboden" seam. Of the latter coal Dr. Stevenson, (who is Professor of Geology in the Univerity of New York), remarks: "It is a *coking coal* of marvelous excellence. The coke will contain less than 3 per cent of ash and barely a half per cent of sulphur. This coke is far superior to that from the Connellsville region, and better than that from the Oxmoor Works in the Cahawba basin of Alabama. It is decidedly better than the coke from the New River region of West Virginia."

The above shows what kind of coals will come to the N. & W. at Bristol, from Imboden. Concerning those that will come to it at New River, from Great Flat-Top, we are as yet but partially informed; miners are now at work opening the beds in the 1,100 ft. of coal measures outcropping between the Bluestone river at the mouth of Crane creek and the crest of the Great Flat-Top escarpment at the head of that creek. Beds of 3½, 4½, 8, 10 and 11 ft. in thickness have already been opened. We reproduce the following analyses, from our July number, as the state of our explorations delays the article we expected to present, in this issue, on this coal-field.

Analyses of Great Flat-Top coals, made by Messrs. Booth, Garrett & Blair, of Philadelphia, July 11, 1881:

	No. 1,	No. 2.	No. 3.
Moisture	1.255	1.080	0.850
Volatile matter	20.175	18.630	20.630
Fixed Carbon	77.675	72.170	72.750
Ash	0.895	8.120	5.770
Coke, per cent.	78.570	80.290	78.520

No. 1 is of coal from the 11-ft. seam known as the "Nelson" bed No. 2 is from the outcrop of a 9-ft. bed on Coal creek; No. 3 is from the outcrop of a 3½-ft. bed also on Coal creek.

The analysts say: "All three samples coke well, that is in the small samples we had to deal with. No. 1, of course, is the best, having the least ash."

The other natural resources of the twenty thousand square miles of Virginia territory tributary to these railways (giving them but fifteen miles upon each side of their lines as their peculiar territory), compare well with their great mineral resources, as briefly outlined above. More than half of this area is as yet occupied by forests having a great variety of timber trees; most of it is excellent land for cultivation, by far the larger part as good land for general farming purposes, grazing, &c., as can be found in any portion of the Union, as the census returns, for successive decades, incontestably prove.

All the essentials for many kinds of manufacturing, are abundant, and at hand, and therefore cheap, in much of the country traversed by these railways, as may be inferred from what precedes; we shall hereafter publish details of facts to fully substantiate these general statements. The whole region in question is, compared with its resources and capabilities, an undeveloped one, and few regions at this time offer greater, or as great, opportunities as this for the profitable employment of talent and capital, where all the conditions of success are so well assured.

Va. Midland RR.—During the 1880 census year this railway took over 12,000 tons of iron ore to Pennsylvania from Pittsylvania county, Va., and over 600 tons of manganese to market from Powell's Fort valley of the N. E. Massanutton mountains, Shenandoah county, Va.

The Virginia State Agricultural Society will hold its exhibition for 1881, at its fairgrounds, Richmond, Va., from the 17th to the 27th of October next. As the Yorktown centennial will be celebrated at the same time, but a few hours from Richmond by railway, it is expected that large numbers of visitors to that celebration will also visit Richmond, Virginia's famous capital. In view of this expected influx of strangers the officers of the Va. Agricultural Society desire to make an attractive exhibit of the resources of the Virginias, especially their mineral ones. To add to the interest of this exhibit we have undertaken, at the request of these officers, the preparation of a geological map of Virginia and West Virginia, on a large scale, a map some 10 by 15 feet in size, on which will be shown the location and extent of the chief geological formations found in these States, the location of all the mines, quarries, &c., now worked, as far as we can ascertain them, the lines of railways in operation or in course of construction, etc. We desire to exhibit, along with this large and costly map, good samples of the ores, coals, marbles, limestones, etc., etc., from the mines and quarries which are located on the map, to form part of a permanent collection, for the Va. Agricultural Society, to be known as THE VIRGINIAS collection, that shall illustrate the geology and mineral resources of these states.—We invite contributions of specimens with note of their exact location, analyses, etc., for this exhibit, assuring our friends that our personal attention will be given to a proper disposition of them in glass covered cases and in a room specially prepared for them on the fair grounds.

Specific Cotton Manufactures in the U. S. (those of fabrics, etc. made wholly of cotton) during the 10th-census year, are treated of by Mr. Edward Atkinson, of Boston, Mass., the accomplished statistician, in Census Bulletin No. 46. From that bulletin and the returns of 1870, we compile the following exhibit of cotton manufacturing in Virginia and in the United States in 1870 and in 1880:

	Virginia.		United States.	
	1880.	1870.	1880.	1870.
Number of looms	1,324	1,310	230,223	157,310
Number of spindles	44,336	77,116	10,921,147	7,132,415
Bales of cotton used	11,461	8,958	1,586,481	838,543
Persons employed	1,112	1,741	181,628	135,369

It is more than probable that the returns for 1870 include numbers that belong to some sub-division of cotton manufactures not yet reported on for 1880.

It appears from this bulletin that in 1880 Virginia ranked among the 30 states that had specific cotton manufactures, 13th in number of looms, 17th in number of spindles, 16th in number of bales of cotton used, and 15th in number of persons employed—West Virginia is not named in this bulletin.

In 1870 Virginia ranked among the 28 cotton manufacturing states as 11th in number of looms, 10th in number of frame-spindles, 18th in number of mule-spindles, 11th in number of persons employed, and 12th in number of bales of cotton used.—From these returns it appears that Virginia is losing ground in this manufacture; a condition of things that ought not to be, when she has so many of the conditions for its favorable and profitable prosecution

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The Textile Record of America, published in Philadelphia, Penn., with Lorin Blodget as editor, is, in every particular, beyond dispute, an imperial exponent of all that pertains to the production of cotton, hemp, flax, silk, wool, etc., and their manufacture in all parts of the world, but especially on this continent. Its views are broad and national, and it states them fairly and boldly. And what a yearling it is! Its August number, the one that fills out the first year of its existence, is a royal quarto of 88 pages (the equivalent of an octavo volume of over 400 pages), 32 of them full of well considered textile and other matter and 52 pages of advertisements, all beautifully printed on the best of paper. It is an American product of which one may be pardoned for being proud.—It is a well-woven fabric from end to end, one that wears and will wear well.—We cannot see how any one interested in the subjects of which it treats can afford to do without it; we would not like to.

The Virginias.—"Thanks for your handsome volume for 1880. Staunton should feel proud of such a production. It would do credit to Boston."—J. M. Hood, Pres. & Gen. Manager of Western Maryland RR., July 28.

Notes on the Geology of West Virginia.

By Jno. J. Stevenson,
Professor of Geology in the University of New York.

(*Continued from page* 100.)

The Disturbed Region.

By this title I designate that portion of West Virginia lying between the line of the Ellenboro fault and the Ohio river, which includes about midway between its east and west boundaries the especially broken tract known as the "oil-break."

The line of the Ellenboro fault crosses the Staunton pike near Webb's mills, on Hughes river. Northward it passes a little west from Harrisville and crosses the railroad about one-fourth of a mile east from Ellenboro. Its place is entirely concealed on the Northwestern pike, though its presence there is indicated by the change in the character of the rocks. How far northward it extends I am unable to say, but if it continue in that direction, it should cross the Ohio river not far from New Martinsville. The best information within my reach leads me to suppose that it disappears long before reaching the Ohio. Southward this fault certainly disappears long before reaching the Great Kanawha river, for, according to Dr. Briggs, the *Pittsburg* coal shows a continuous outcrop across the state through Braxton, Clay, Kanawha and Putnam counties to the Ohio river. Indeed, in every respect the disturbance from east to west in this region seems to have been greatest in the vicinity of the line followed by the railroad. Near Ellenboro the fault is quite abrupt and is seen to good advantage in the creek's bed, about one-fourth of a mile from the station. On its eastern side the rocks of the Upper Barren Group are seen turned up and dipping at 26°, while on the west side the strata of the Lower Barren Group lie almost horizontally. The direction of the fault is about N. 10° E. Mag. and the upper rocks dip S. 8° E. Mag.

From this fault westward, the strata are almost horizontal, or have an easterly dip so slight that it cannot be determined by the barometer, until the edge of the oil-break is reached where they are abruptly turned up at a high angle. Within the "break," a narrow strip, nowhere more than two miles wide, the dip is irregular, but shows traces of anticlinal structure, and at no time exceeds 5°. On the west side the conditions seen at the east are repeated. The strata are sharply upturned and dip towards the west. The angle of dip quickly diminishes and soon becomes only 10 ft. per mile. About five miles east from Parkersburg, another fault occurs, quite as sharp as that at Ellenboro, with the upturned rocks dipping westward. Beyond this, the rocks are almost horizontal to the Ohio river.

On each side of the oil-break the strata belong to the Lower Barren Group, as far east as the Ellenboro fault and as far west as the fault near Parkersburg. What the rocks between this fault and the Ohio river are, can be determined only by approaching them from Ohio. Before entering into a discussion of the "break," it is well to describe these rocks as they occur east and west from it.

Lower Barren Group outside of the Oil-break.—Near Ellenboro, and almost directly on the edge of the fault a boring was made several years ago in search of oil. No record has been preserved, but the enterprise proved unsuccessful. Both fresh and salt water were found, and a little oil was obtained. The rocks appeared to be much shattered. At first the drill descended nearly 20 ft. each day, and farther down many crevices were struck, in which the tools would drop four or five feet instantly. Five hundred feet down, the drill stuck fast and the work was abandoned.

Along the railroad, westward from Ellenboro to near Petroleum, the section appears to be:

	Ft.		Ft.
1. Debris with nodular limestone	75	5. Sandstone	15–25
2. *Coal*	1	6. Red and blue shale	25
3. Flaggy sandstone	40	7. Sandstone	10
4. Red shales	10	8. Red shales and sandstone	300

The limestone and coal both were seen near Ellenboro, as well as in the hills near a deep cut 3 miles farther west. This coal, I take to be the same with that whose blossom is seen in the roadside between Harrisville and Cornwallis station, not far from the former place. The sandstones, Nos. 5 and 7, are soft, light gray, somewhat feldspathic and contain much mica. The upper is the more compact and durable. Both may be seen near Cornwallis station, where the upper stratum is quarried extensively by the railroad company for building purposes. The lower one is apt to become flaggy. No. 8 is first seen near Cornwallis, and is the prevailing rock exposed in the cuttings from that place to near Petroleum, except near Silver Run summit, 4 miles east from Petroleum, where the grade of the road brings one into the upper members of the group. The shales greatly predominate. When freshly exposed, they resemble a reddish shale enclosing nodules of sandstone. The whole, however, is a mass of slightly arenaceous clay shale, without definite bedding, of a dull red color, with brownish patches, and readily breaking up into coarse powder on exposure. The color is characteristic, and once seen cannot fail to be remembered. No such shale occurs in the Upper Barren Group. It does occur in the Lower Barren Group along Buckhannon river and the Staunton pike, in Upshur county. No other group resembles it except the Red Shales of the Lower Carboniferous. Near Petroleum we find under it a sandstone, which, doubtless, belongs to the Lower Coal Group.

Along the Northwestern pike only the upper members of the group are exposed, until one approaches the eastern slope of the "break"

Southward from the railroad the rocks show the same character. At a short distance west from Harrisville a boring was made for oil. It was continued to a depth of 500 feet and then abandoned. No record of it is accessible. I am informed that for most of the distance the drill passed through red shales, and that two very thin beds of coal or carbonaceous shale were passed through. On the Staunton pike, these rocks are well exposed for nearly 20 miles, by the road. They are said to contain two very thin beds of coal. Of one of these I saw the blossom about 3 miles west from Webb's mills. It seems to be about 10 inches thick. A very notable feature just east from the break is a sandstone, about 20 feet thick, resting on the shale.

Leaving aside, for the present, all reference to the strata involved in the slopes of the oil-break, we pass across the break to the west, where we find a similar series of rocks, differing only in this, that the red tint is not the only one in the shale, many portions along the railroad having a bluish cast.

Upon the line of the railroad, west from Laurel Junction, we find the rate of dip quickly decreasing to less than one degree. Before reaching the tunnel, one mile west from the Junction, the blossom of a thin coal is seen in a low cut. This is probably 200 feet higher than the rocks in the Junction cut, and is overlaid by a mass of bluish-red shale and sandstone. From the tunnel westward to Walker's station, the grade of the road falls, and meantime the dip becomes barely 10 feet per mile. Nearly one mile east from Walker's, a thin coal is seen which may be traced through several cuts. It is 8 inches thick, very slaty, and is no doubt the same with that just mentioned. Above it, in the hills is a succession of sandstones and red shales. Similar rocks occur all the way to Parkersburg. No break or fault was seen along the railroad, but in a well bored near Claysville, the strata are said to have been found much shattered. On the Northwestern pike the exposures are very incomplete; no succession can be made out, but there are evidences of at least two small breaks in the continuity of the rocks.

Upon the Staunton pike, the exposures are quite as satisfactory as those along the railroad, for the road runs in the valleys cut by the Little Kanawha and Hughes rivers. Starting up the Little Kanawha from Parkersburg, we find at five miles from that city a well marked break or fault, very similar to that observed at Ellenboro. Up to this point the westward dip is almost zero; but here at once it increases to 25°. The exposure is at the roadside, in a cut. East from this break the strata are horizontal, at least no dip in any direction can be made out with the barometer. On both sides the rocks are apparently the same. Sandstones and brownish red, slightly arenaceons shales. Judging from their lithological characters alone, one would regard them as belonging to the same group. At a short distance below Newark, the road passes through a cut, in which is exposed a series of sandstones and dark red shales, in all about 125 feet thick. On top there is a handsome, light olive sandstone, which is quarried to supply material for building the locks on the river. Though soft, it is said to be quite durable.

At Greenville, where the road crosses Hughes river, the same shaly sandstones and shales are seen in the river bluffs, and at some distance farther on, the massive sandstone appears in the hills, 20 feet thick and standing out as a cliff. Huge fragments of it have fallen off and lie strewn over the hillside, and in the river channel. It has been used here for building purposes, and serves well, as it is not very hard, dresses easily and is quite durable. This rock is seen along the road to within one mile of Freeport P. O., where the exposures become obscure, as we are approaching the western boundary of the oil-break. It is the same sandstone with that already mentioned as occurring just east from the break on this pike.

The Oil-Break.—This name is given to an irregular tract, from one to nearly two miles in width, having a general trend of N. 10° E. (Mag.), and with the strata on its sides, dipping N. 80° W. and S. 80° E. (Mag). I have been able to examine it along the Staunton pike, the Northwestern railroad, and the Northwestern pike, as well as at several points between these lines, embracing in all about 15 miles of its length. The region of greatest disturbance is in the neighborhood of the railroad; north and south from this line the abruptness diminishes. Its extent southward is not well determin-

ed. Col. Byrne, State Superintendent of Instruction in W. Va., informed me that he had traced it to the Great Kanawha river, near Charleston. This seems hardly possible, for at the Great Kanawha, in that vicinity, there is no anticlinal, certainly there is no break. It is, however, by no means improbable that the remarkable horizontality of the strata there may result from the flattening out of this anticlinal in that direction, so that if the flattening occur gradually southward, the anticlinal might be traced to that river.

Northward, where the break crosses the Ohio river near Cow run, it is said to be a gentle anticlinal, over which the upper rocks pass unbroken; and this belief is supported by Dr. Briggs' section along the Ohio. (Rogers' Report Geol. Virginia, for 1840.) In that section the whole mass between Wheeling and Pomeroy is referred to the Upper Coal Group, and the *Pittsburg* coal is regarded as being at no point more than 250 feet under the river. There is certainly an error somewhere in this work, since in that portion of West Virginia, fronting on the river, a little south from Marietta, the surface rocks belong to the Lower and not to the Upper Barren Group, for I have found the section along the Staunton pike to be the same on both sides of the break, and along the railroad it is practically the same. I have no records of borings made west from the break, but two on the east, one near Ellenboro and the other near Harrisville, were driven 500 feet and passed all the way through shales and sandstones, cutting at most only two streaks of coal. If these rocks belong to the upper series, the *Pittsburg* coal should have been struck at about 300 feet from the surface near Ellenboro, and at much less near Harrisville. At Wolfe's summit, eight miles west from Clarksburg, the *Pittsburg* goes under, dipping northwestward, at the rate of somewhat more than 100 feet per mile. From that place westward to Ellenboro, the strata of the Upper Coal and Upper Barren Groups are followed without a break, the dip continuing northwest all the way, though gradually diminishing in sharpness. At Ellenboro, the rocks change and the dip becomes slightly eastward. From this line we find only the characteristic red shales with the accompanying sandstones until we reach the oil-break, where the rapidly-increasing dip brings us into the Lower Coal Group. As will be shown farther on, the rocks within and the steeply-sloping sides of the break form a continuous and uninterrupted series with those outside. If this series between the oil-break and the Ellenboro fault belong to the Upper Barren Group, what has become of the Lower Barren and Upper Coal Groups? Neither of these is found along the Staunton pike, where the whole structure is very clearly exposed. It is absolutely certain that the *Pittsburg* coal appears nowhere between the Ellenboro fault and the one a little way east from Parkersburg, except possibly in isolated patches on tops of the very highest hills.

Dr. Briggs' statement can be accounted for only by supposing that the Ellenboro fault disappears long before reaching the Ohio, and that the oil-break itself flattens out rapidly, so as to become a low anticlinal near the river, over which the upper groups may pass unbroken. Still this does not wholly remove the difficulty. What the condition may be above Marietta, along the river, I do not know, never having examined that region; but I do know that rocks belonging to the Lower Barren Group are found near Valley Mills, in Wood county, 3 miles from the river, and 7 miles northeast from Parkersburg. In that vicinity, I was unable to discover any rocks belonging to the upper groups.

The oil-break passes through Wirt, Ritchie and Pleasants counties. Beginning at the south, let us see the structure in the vicinity of the Staunton pike, which runs along Hughes river. The section of the west slope is very prettily exposed on Fox run, about 1 mile north from the Staunton pike, where we find:

	Ft.		Ft.
1. Red shales	not measured	5. Red shales	50–60
2. Shaly sandstones	20	6. Sandstone, shaly to massive	65
3. Red shales	105	7. Chert	5–12
4. Shaly sandstone	30		

No. 1 is not far from 100 feet thick, and on it rests the massive sandstone already mentioned as seen along the pike west from the "break." Nos. 4, 5, 6 and 7 are wholly involved in the abrupt side, and No. 3 partially so. The sandstones are all of a dull red color, and in the wells bored just outside of the break, the whole mass was recorded as red shale. On the east side of the break the exposure is yet more satisfactory, as the road passes along the river bank, so low down as to exhibit the flexure in the flint where the dip abruptly decreases from 35° to 3°. The sandstones and shales of the preceding section are seen in the hill above the flint, thus proving indisputably that the rocks on each side of the "break" belong to the same horizon. There is no evidence of faulting on either side. The succession from the inner portion of the abruptly tilted strata outward to the horizontal strata is unbroken and perfectly clear.

Within the break the rocks are almost horizontal and not much broken. They describe a flattened anticlinal, for beginning inside and proceeding outwards, say on the west side, we find the dip first horizontal, then 2° or 3°, then 28°, then 56°, then 3° or 5°, and finally outside almost horizontal. A similar condition is found on the eastern edge. Along the line of the section the chert is the last to show the abrupt dip.

If now we descend the hill from Fox run and go east about one-third of a mile, we find near Mr. Sharpnack's steam mill, the sandstone and chert almost horizontal. The sandstone is the highest rock in the hill. The section is as follows:

1. Sandstone	60 ft.	5. *Coal*	6–12 in.
2. Chert	6–12 ft.	6. Shale and sandstone	120 ft.
3. Shale and limestone	9 ft.	7. Sandstone to river	not measured.
4. Black shale	3 ft.		

The chert is light-red to yellow and in some cases dove colored. It is quite compact, and forms a striking feature in both sides of the break as well as on the hills within it. It is well exposed on the pike, where it has been used for macadamizing the road. The limestone in No. 3, occures in nodules, varying from 2 inches to 2 feet in diameter. It is variegated and extremely compact. If a sufficient quantity could be obtained, this would be valuable as an ornamental marble for indoor use, since it receives a beautiful polish. The *coal* is sulphurous and slaty. It has been seen on the pike near each edge of the break. The sandstone, No. 1 is said to contain a *coal*, 8 inches thick. The black shale overlying the *coal* No. 5, is quite rich in fossils. In a few minutes I obtained from it a large number of individuals belonging to the following species: *Chonetes granulifera*, *Solenomya sp.*, *Schizodus sp.*, *Pleurotomaria grayvilliensis*, *Bellerophon montfortianus*, *Bellerophon percarinatus* and *Euomphalus subrugosus*. From this shale very fine specimens of a *Nautilus*, allied to *N. occidentalis* have been procured.

Near Freeport P. O., midway in the break, a well was bored to the depth of 1,500 feet, but the record seems to be wholly lost. All accounts agree in stating that for several hundred feet before the work was stopped, the drill passed through nothing but red shale. In a boring made near the middle of the break, thin coals are said to have been met at 60, 80, and 120 feet, respectively, from the surface. By comparing the results of two borings made here by Mr. J. Lillie, I make out the following partial section within the break:

1. Sandstone	60 ft.	11. Sandstone	76 ft.
2. Chert	6–12 ft.	12. Shale	14 ft.
3. Shale and limestone	9 ft.	13. *Coal*	3 ft.
4. Shale	3 ft.	14. Shale	20 ft.
5. *Coal*	6–12 in.	15. Sandstone	27 ft.
6. Shale	30 ft.	16. Shale	6 ft.
7. Sandstone	59 ft.	17. Shale, black	10 ft.
8. Shale	41 ft.	18. Shale	50 ft.
9. Sandstone	105 ft.	19. Sandstone	20 ft.
10. Shale	9 ft.		
		Total	553 ft.

Oil was found in Nos. 9 and 19. The *coal*, No. 13, is said to be very soft and in appearance to resemble the Grahamite. It is not exposed everywhere and has been found only in borings.

Respecting the horizon of these rocks there is no room for doubt. The chert is undoubtedly the same as that found on the Great Kanawha river, immediately below the Mahoning Sandstone. Here, as so frequently elsewhere in W. Va., that sandstone holds a thin bed of coal. The shale below the chert is rich in species of fossils, which, in the Apalachian region, are thus far utterly unknown at every horizon above the middle of the Lower Barren Group. Such a fossiliferous shale is very often found between the Mahoning Sandstone and the immediately underlying coal. From the sandstone down, the whole facies is that of the Lower Coal Group, and at an inconsiderable depth the shales of the Lower Carboniferous are reached.

Along the line of the Northwestern railroad, the conditions are much more complicated, and one finds some difficulty in working out the true structure. Here the uplifting agency was exerted much more energetically than on any other line, whether north or south from the railroad.

Approaching Laurel Junction from the west, we pass through the Lower Barren Group. The strata are dipping westward very slightly until we approach the station, when the dip instantly changes to 30°, and within a very short distance increases to 75°. It then declines almost as rapidly to 2° or 3°. On the east side of the break near Petroleum, the conditions are similar, the easterly dip suddenly increasing from a fraction of 1° to 20°, and then to 36°. On each side of the break the uplifted rocks are certainly not far from 800 feet thick, and they may possibly be somewhat more. The disturbed conditions render it difficult to make a good estimate. In these rocks we find near Laurel Junction a thin coal bed, 1 foot, separated by about 10 feet of shale from a slaty coal, barely 8 inches thick. Both coals are badly broken, fire-clay and shale having been forced into them. From information given me by Prof. Fontaine, I am inclined to think that this same double bed is seen a little farther east in another cut, still sharply upturned. Near Petroleum, a similar bed is involved in the abruptly sloping

rocks, and a little east from that village a thin coal is occasionally worked, which is said to be double and to resemble the one under consideration. There seems to be no room for doubting that the coal at Laurel Junction and that at Petroleum are the same.

Prof. Fontaine, nearly two years ago, made a very careful section along the railroad from Laurel Junction to the middle of the break, where the summit of the anticlinal is shown. He has very kindly submitted his notes to me without restriction. In the main, the results of my observations do not differ from those previously obtained by him. I do not reproduce the section, as the details are unimportant here.

Within the break, that is, in that narrow portion where the rocks lie somewhat irregularly horizontal, a *coal* is seen in several cuts. The section in connection with it varies slightly, owing to crushing, while the coal itself exhibits every evidence of having been subjected to strong pressure. The following sections were obtained at different points upon the railroad. No. I, being by Prof. Fontaine, and No. II, by myself.

I.		II.	
1. Massive sandstone	12 ft.+	1. Sandstone, massive	25 ft.
2. Black arenaceous shale	5 in to 4 ft.	2. Shale	2–4 ft.
3. *Coal*	30 in.	3. *Coal*	15–23 in.
4. Gray sandstone	3½ ft.	4. Sandstone and shale	6 ft.
5. *Coal*	8 in.	5. *Cannel*	10 in.
6. Black shale	3 ft.	6. Clay	3 in.
7. Flaggy sandstone	....	7. *Coal*	8–12 in.
		8. Shale to track	6 ft.

At the base of the massive sandstone there is a thin layer of conglomerate made up of rounded pebbles, one-half inch in diameter and cemented by oxide of iron. The shale contains no impressions of plants. This seam is evidently the same as that mined near Volcano, about one mile north from the railroad, where the section to the coal, as contained in a well, is shale 40′; sandstone 40′–50′; *Coal*, 3′–5′. The *coal* is double and very irregular in thickness. Below it the rocks are principally sandstone to a depth of nearly 500 feet, beyond which are reddish shales, which have been bored to 700 feet more without reaching their base. Two thin coals have been found within the break above this bed, but they are not persistent.

Within the break the strata are thrown about in considerable confusion, and well-marked faults are not infrequent along the railroad line. One of these is exhibited in the following figure, which, as well as the description, I take from Prof. Fontaine's manuscript, the details being more satisfactorily given than in my own notes.

The fracturing of the rocks is especially marked on the western side of the break. The superintendent of one of the oil companies informed me that, on that side, it has never been found necessary to "torpedo" the wells, while that expedient is necessarily resorted to on the east side. The anticlinal structure is well shown west from Petroleum in the first cut which exposes the *coal*.

There is no room to doubt that the original structure here was that of anticlinal, but certainly there is no true anticlinal now. This is easily shown by reference to only a few facts.

East and west from the break along the railroad, the rocks do not differ materially in character from those in similar position along the Staunton pike, where the relations are very clear. They are, therefore, of Lower Barren age. Borings made near the pike, say 12 miles south from the railroad, show the thickness of the Lower Coal Group and the Conglomerate to be not far from 600 feet, and borings immediately north from the railroad show about the same thickness. In the several cuts near Laurel Junction on the railroad, there are exposed several hundred feet of strata dipping at angles varying from 10° to 75°. These cannot belong wholly to the Lower Barren Group, for by far the greater portion has no equivalent in that group, being sandstone clearly underlying the mass of shales. From what we know of the Coal Measures in this portion of the trough, it is deemed impossible for the Barren Group to increase so enormously within barely 12 miles. The greater portion of these upturned rocks must belong to the Lower Coal Group, and must be identical with the shattered fragments arranged in rude horizontality between the sides of the break.

Such being the case, it is evident that we have here the remains of an anticlinal. All the conditions go to show that the upheaval was not slow, but very violent, even explosive. It seems that the rocks had been blown out with such force as to fracture them on the crest of the anticlinal and as though the fragments, thus produced, had fallen into the broad gulf and keyed up the sides. In conversation Prof. Fontaine has compared the conditions with those which would result if the top of a hollow anticlinal was battered in, and the simile is a good one. What the nature of the agency producing the disturbance was, it is difficult to determine. It certainly was exerted over a broad area, extending in the region examined from the line of the Ellenboro fault to the Ohio River. Fissures are frequent throughout this area, the most notable one being that containing the Grahamite. This has been fully described by Prof. Fontaine in the American Journal of Science.

The oil is obtained chiefly from rocks, which I regard as belonging to the Great Conglomerate. The grade, for which this region is particularly noted, is of heavy specific gravity and is known as lubricating oil. Lighter oils are obtained, but occur at a greater depth than the others.

Appendix.—Since writing this paper I have received from Dr. W. H. Sharp, of Volcano, West Virginia, the records of 18 borings made in different portions of the oil break. A comparison of these leaves no room for doubt that the strata within the break, though apparently horizontal, are badly broken up, in many places even dove-tailing or not infrequently crushed into irregular masses. This is sufficiently evident from the variations in the interval between two well marked strata,—the coal-bed, already mentioned, and a limestone at some distance below. It is possible, however, to make an approximate estimate of the thickness of the rocks, for several wells bored at somewhat distant localities show a close agreement. I give condensed sections of four borings. No. I is near the eastern edge; No. II is in similar position, but one mile farther south; Nos. III and IV are near the central line of the "break" and were made on lots 56 and 33 of the Volcanic Company's tract.

I.	Ft.	
1. *Coal*	3	
2. Shale	7	387 feet
3. Sandstone	23	
4. Dark Shale	63	
5. Gray Sandstone	79	
6. Light Shale	33	
7. Gray Sandstone	24	
8. Shale and S. S.	81	
9. Aren. Shale and L. S.	77	
10. *Limestone*	22	
11. Shale	101	133 ft.
12. Sandstone	32	
13. Variegated Shale	388+	

II.	Ft.	
1. *Coal*	3	
2. Interval not given in detail, but chiefly Gray Sandstone	233	
3. *Limestone*	25	135 ft.
4. Shale and Sandstone	123	
5. Sandstone	12	
6. Variegated Shale	213	

III.		
1. *Coal* and Shale	8	
2. Sandstone	80	426 feet.
3. Dark Shale	32	
4. Gray Sandstone	16	
5. Shale	128	
6. Sandstone	170	
7. *Limestone*	8	
8. Sandstone and some Shale	128+	

IV.		
1. *Coal* and Shale	11	
2. Sandstone	17	388 feet.
3. Dark Shale	12	
4. Sandstone	58	
5. Shale	48	
6. Shale and S. S.	23	
7. Sandstone	82	
8. Sandstone and S.	56	
9. Sandstone	42	
10. *Limestone*	17	
11. Sandstone &c.	39+	

In these sections the interval varies from 233 to 426 feet. In another boring, which passes through both the coal and the limestone, the distance is 364 feet. Two other wells were driven to a depth of 386 and 397 feet respectively below the coal, without reaching the limestone. In all these wells the succession of strata is strikingly similar, though there is no resemblance in the thickness of the individual layers. It seems quite probable that the interval is not far from 300 feet, making all due allowance for exaggerated thickness owing to irregular dip of the rocks. The abrupt variation in the interval can be accounted for only by supposing that the strata are not only broken, as they usually appear in many of the railroad cuttings, but also actually crushed by lateral pressure, as indeed is shown in one of the illustrations given above. That this crushing is a common phenomenon appears from the frequent occurrence of the term "floating sand" in the records.

The record of one boring gives, as overlying the limestone, "18 feet of sandstone and *coal*." Since the coal is referred to in no other record, I am inclined to regard the statement as an error. Above the main coal and separated from it by a thin stratum of shale, there is in every instance a sandstone, whose thickness appears to vary from 20 to 80 feet. On this in two localities and 85 feet above the main bed is a thin coal, 2 feet thick, and, at one place, still another seam, of similar thickness occurs 63 feet higher. Above are shales for a considerable distance, probably 200 feet. These borings confirm the conclusion, previously given, that the main coal is the Upper Freeport of Pennsylvania, the No. VI of Ohio.

Eleven of the borings pass through the limestone and 5 others show by their sections that they have stopped not far short of it. In 14 of these, the overlying rock is described as sandstone and in the other two as sandy shale. In 12 instances the sandstone is more or less conglomerate. Respecting the limestone I have no direct information. It is seen in the run near the railroad, a short distance east from Laurel Junction, but no search has been made in it for fossils. Under the limestone, sandstone occurs in 10 borings and black shale in one. In four instances the sandstone is quite conglomerate. Below the sandstone is the variegated shale, whose

thickness is unknown. Near the Staunton pike it is more than 700 feet.

This succession leaves no room to doubt that the overlying rock is the Great Conglomerate, that the limestone is the Lower Carboniferous limestone (Umbral) and that the underlying rocks are the Waverly Conglomerate and shales (Vespertine).

Oil is found in the Great Conglomerate as well as in the shales and Conglomerate of the Waverly. The heavy lubricating oil, for which this district has been celebrated, occurs at the upper horizon, while the lighter oils are obtained at greater depths. Dr. Sharp informs me that extensive "water-veins" are seldom encountered in the borings.

Cotton Production in Virginia.—Bulletin 250 of the 10th census, by Prof. E. W. Hilgard, is a preliminary report upon cotton production in the U. S. in 1879, the year reported in that census; from it we gather the following Virginia cotton facts. The bale of that census year is assumed to have been 475 pounds.

Virginia, ranking 13th among the States in order of production, produced 11,000 bales, (5,225,006 pounds) on 24,000 acres, ranking as 6th among the 14 cotton states in bale production per acre, out-ranking in this particular Tenn., Miss., N. C., S. C., Tex., Geo., Ala. and Fla., which rank from 7th to 14th in the order in which they are here named. The U. S. crop for that year was 5,737,257 bales.

The Virginia product per acre was 0.46 of a bale, (about the same as in Tenn. and Miss.) or 654 pounds of seed-cotton, 218 pounds of lint, and 436 pounds of cottonseed to the acre, on the accepted average proportion of one part of lint to two of seed in the seed-cotton as it comes from the field.—The largest average yield per acre in any single county in all the cotton states was 0.95 of a bale in a county of La.; the largest county yield in Geo. was 0.48 of a bale, and in Ala. 0.44. In the "cotton states proper," N. C. to Tex,, as Hilgard calls them, the production was about one bale to every two of their inhabitants.

Mississippi, the leading cotton State, produced over half its crop on the first-class uplands, and another fourth on its sandy uplands. Georgia stood second, though she produced an average of but 0.53 of a bale per head and but 0.31 of a bale per acre,—"her high position," says the bulletin, "is due, not to natural advantages, but to better cultivation of the soil, the use of fertilizers, and the thrift of an industrious population"; the reports show an extension of her cotton culture even to beyond the Blue Ridge.

North Carolina had 893,153 acres in cotton and made 389,590 bales, or 0.44 of a bale to an acre, ranking 8th in production; South Carolina had 1,364,249 acres in cultivation and made 522,548, bales, or 0.38 to an acre, ranking 6th in order of production.—Of these states the bulletin remarks:—"In both States the average cotton product per acre is high as compared with Geo. and Ala., and, in the case of N. C., approaches that of Miss. itself. Without entering into details on the subject of the distribution of cotton production in these States, it may be broadly stated that the production of cotton is reported to have been greatly extended of late, even up the slopes of the Blue Ridge itself. Among the causes leading to this gratifying result, reports received show that the use of fertilizers, and, with them, better methods of culture, are foremost.—In other words, these two members of the original union of thirteen have been first to place cotton culture upon a permanent foundation, by adopting a system of regular returns to the soil."

The bulletin says: "Data regarding the production of cotton in Virginia are at this time too scanty to warrant a discussion. It seems, however, that there, also, cotton production has increased materially during the last decade, owing, doubtless, to the use of fertilizers."

Virginia, according to the census returns, produced 5,054,800 pounds of cotton in 1860, 73,200 in 1870, and 5.225,000 in 1880. By these statements Virginia made about 72 times as much cotton in the 1880 census year as she did in the 1870 one, showing a most remarkable and encouraging advance; she also made a gain of 170,200 pounds, or over 3 per cent, on her crop of 1860, which, with organized labor and under the stimulus of peculiar circumstances, was much the largest, so far as we can learn, she had ever made in any one year.

Bonded Indebtedness of Virginia Cities.—Census of 1880, Bulletins Nos. 70 and 246, treat of the outstanding bonded indebtedness of U. S. cities containing a population of 7,500 and upwards. The Virginia cities included in this list, and their population in 1880, are:

1. Alexandria	13,658	6. Petersburg	21,656
2. Norfolk	21,966	7. Lynchburg	15,959
3. Portsmouth	11,388		
4. Richmond	63,803	Total	155,056
5. Danville	7,526		

The total bonded indebtedness of these cities is reported as $10,707,177, or $68.64 per capita. Of this debt $2,000 bore 10 per cent interest: $3,679,901, 8 per cent; $141,900, 7 3-10 per cent; $5,934,266, 6 per cent; $88,010, 5 per cent; and $859,100, 3 per cent.—The average per capita of indebtedness in cities of New England States was $62.18, in Middle States $76.51, in Southern States $55.86, and in Western States $32.28; that for the United States was $58.53. The per capita indebtedness of the Virginia cities was $7.87 less than the average for those of the Middle Atlantic states, the ones with which for topographical and commercial reasons, they should be compared. The per capita in New York was $81.46, in New Jersey $76.69, in Pennsylvania $63.26, and in Maryland $103.91, in comparison with which the standing of Virginia cities is exceedingly to their credit.

The purposes for which this $10,707,177 indebtedness was incurred, and the amount for each purpose, is thus stated:—For fire department, $1,000; funding floating debt, $301,048; improvement of harbors, rivers, wharves, canals and water power, $74,000; public buildings, $45,454; railroad and other aid, $2,494,766; refunding old debt, $5,199,345; schools and libraries, $70,000; streets, $711,600; war expenses, $34,900; water works, $685,000; and miscellaneous, $1,090,071.—This shows that more than half of this indebtedness was incurred in aiding the construction of railways.

Wheeling is the only W. Va. city embraced in this exhibit. Its population was 31,266; bonded debt $506,500; per capita bonded indebtedness $16.20, giving W. Va. one of the lowest averages in the U. S. This indebtedness was incurred, $10,000 prior to 1860; $129,000 in 1860; $200,000 in 1871; $56,500 in 1875; and $111,000 in 1877. The interest paid is 7½ per cent on $256,500, 6 per cent on $126,000, and 3 per cent on $124,000. The bonds were issued, $200,000 for funding floating debt, $15,000 in aid of railways, $56,500 for public buildings, and $235,000 in refunding old debt. Its bonds mature, $15,000 in 1880, $56,500 in 1885, $200,000 in 1891, $124,000 in 1900, and $111,000 after 1900. The floating debt was $25,382, making the total indebtedness of Wheeling $531,882, or $17.01 per capita.

The Mineral Traffic of Virginia Midland Ry., for the 6 months of 1881 ending June 30, by months, kindly furnished The Virginias by President John S. Barbour, was as follows, in tons of 2,000 pounds:

	Jan.	Feb.	March.	April.	May.	June.	Total.
Iron ore	1,042	2,463	3,175	3,553	2,276	891	13,400
Barytes	120	209	272	190	189	234	1,214
Manganese	....	....	12	20	....	13	45
Copper ore	....	....	....	....	20	....	20
Gold ore	....	....	....	1	7	....	8
	1,162	2,672	3,459	3,764	2,492	1,138	14,687

Of this traffic all the movement of copper, gold, and manganese ore was northward; of the iron ore 518 tons were moved southward, probably that delivered to the Chesapeake & Ohio, referred to on page 114,—the remainder, 12,882 tons, went northward, ore, we suppose, mainly from Pittsylvania and Franklin counties, Va., on its way to the Pa. Steel Co., near Harrisburg, Pa. Of the barytes about 2½ tons went southward, probably to the mills at Lynchburg, the remainder went northward.—We hope to have fuller details of the mineral traffic of this railway, one that traverses a rich but almost undeveloped mineral region, hereafter.

Lumber.—The Chesapeake & Ohio Railway is now consuming lumber and timber at the average rate of 600,000 feet a month. In the 7 past months of this year its consumption has been 4,200,000 feet, brought mainly from along its line in W. Va. Much of this has been used in the Newports-News extension.

Connellsville vs. New River Coal and Coke.—In the *Keystone Courier*, of Aug. 19, 1881, published at Connellsville, Pa., we find the following:

"THE STAUNTON VIRGINIAS of a recent date, gives an analysis of the New River coal and coke, which accredits the former with seventy-five and the latter with ninety-one per cent. carbon, and proceeds to take the *Courier* to task for daring to assert the superiority of Connellsville coal and coke over those of the Virginias. We cannot combat such figures as these, it is true, but we are not compelled to accept them as strictly accurate. Our opinions are not based upon the flattering reports of paid chemists, but upon the observations of practical and experienced coke men, personally known to us to be reliable, who have traveled through the coal and coke regions of Virginia and West Virginia for the express purpose of examining into the merits of this matter, and the unanimous opinion of these is that the Connellsville coke is undoubtedly superior. We do not impugn the sincerity of our esteemed and able contemporary, for whose opinions in matters of this kind we have the utmost respect, but the natural tendency of coal owners to exaggerate the quality of their product has doubtless deceived THE VIRGINIAS."

Our reply to this "way of getting out of it" is, that we never publish analyses or statements unless they come from everyway reliable men, and we comment on these so that no one can be deceived by them. The analyses in question were made by A. S. McCreath, a chemist of established reputation, one that for years has been the chemist of the Geological Survey of Pennsylvania, a position he still holds. We must say, with due respect, we think our cotemporary is harsh in his criticism of the work of its own State Chemist. If the *Courier* had published the analyses in question and our comments thereon, so its readers could have had the whole question before them, we would not have made complaint, and (pardon us for so saying) we think it would not have commented as above.

The analyses and statements we have from time to time published from such men as Egleston Stevenson, Firmstone, Britton, McCreath, Booth, Garrett & Blair, etc., in reference to the character of the Virginia coals and cokes, and the results obtained from their use in Virginia, Kentucky, Ohio and other States, fully establish our position in reference to their unsurpassed character as metallurgical fuels. We have no controvery with Connellsville, *only*, its papers must not be so naughty as to say our coals and cokes "*are vastly inferior*" to theirs. To the end that they and others may be correctly informed in regard to the true character of our fuels, we will continue to publish just such information as we have hitherto, assured that it will be accepted, the world around, as it now is, as thoroughly reliable.

Condition of S. W. Va. Furnaces.—We are indebted to our good friends, D. S. Forney, of Allisonia, Pulaski Co., and J. W. Robinson, of Graham's Forge, Wythe Co. Va., for the following information concerning the condition of the S. W. Virginia charcoal blast furnaces named, July 31st, 1881, and the pig iron made by them, to that date, in 1881.

Furnaces in blast.	Went into blast.	Tons made in 1881.
Reed Island,	May 1st.	500
New River,	May 1st	400
Cedar Run,	April 2d	475
Walton,		250
Raven Cliff		600
Beverley	July 1st.	100
Iron Dale,		700
Speedwell,		300
Total,		3,320

Furnaces out of blast July 31st, 1881:
Barren Springs.
Brown Hill,—goes into blast this fall.
Eagle,—goes into blast Sept. 1, 1881.
Wythe,—goes into blast this fall.
White Rock,—goes into blast this fall.

About 480 acres of the "Ruffner" coal land, on and near Campbell creek, Kanawha county, W. Va., near Malden, but across the Kanawha from the Chesapeake and Ohio Ry., was lately sold, to the Campbell's Creek Coal Co., for $40,000, as we learn from one of the vendors.

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Wm H. Edwards, of Coalburg, Kanawha Co., W. Va., Pres't of Kanawha and Ohio Coal Co.
Isaac N. Smith, Charleston, Kanawha Co., W. Va.

Isaac N. Smith, of Charleston, Kan. Co., W. Va., ...Solicitor.
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These companies have been organized for the de velopment of valuable coal loads owned by them. They are now constructing a first-class railway through the properties, having its terminus in the pool above Lock and Dam No 3, part of the mprovements now being constructed by the U. S. Governmen on the Kanawha River. This railway will be completed and equipped for transportation of coal in September, 1881. It crosses the C. & O. Ry. and connects with it, so that shippers will have every facility for both river and railway trade.

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Their Cannel, Splint, Bituminous and Coking Coals are unexcelled in quality, quantity and size of workable seams—the principal splint coal seam averaging ten feet.

Application for leases may be made to the President direct or through any of the Directors.

More particular information given upon request, by mail or otherwise, to L. L. Conrad, President, 15 Lexington street Baltimore, or Isaac N. Smith, Charleston, Kanawha county, W. Va., Solicitor of the Companies.

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We offer the fee simple in the MINERAL RIGHTS on 750 acres of land, immediately on the James River Canal and the Richmond & Alleghany RR. This property is situated a short distance below Riverville, in the heart of the magnetic and specular ore belt of the James River Valley. It is one of the most valuable iron ore properties now on the market—the deposits being very large, and the ore of the purest quality Price $16,000.

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The property has a river front of about one mile, with good water for loading and holding boats.

A large Salt Furnace, on the property, with a capacity of 300 barrels per day, will be leased with, or separately from, the coal land.

For further information apply to

D. H. WILLARD,
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I offer for sale the Residence of Mrs. Virginia B. Donaghe, fronting on three of the principal streets—Main, Lewis and Frederick—in immediate proximity to business, churches, schools, &c. The improvements are first-class, and the property one of the best, if not the very best in the city, either as a home or a speculative investment. It will be subdivided if not sold as a whole. Examination invited.

Terms:—Ten per cent. cash, and balance at one, two, and three years, with semi-annual interest.

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The undersigned, as President of a Land Company, has for sale or lease, on favorable terms, some of the best coal and timber lands in the New River District, on the line of the Chesapeake and Ohio Railway. The coals on these lands are the **Coking Coals,** the coke from which is now so much in demand for blast-furnace and other metallurgical uses. For further information and terms, apply to

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The Twelfth Session of this school will open the 1st Monday in September, and continue Forty Weeks. With all the equipments of a first-class school, the cost of a pupil is far below that of most schools of like grade, because of more moderate rates, but especially on account of the economy that is required of ALL pupils in DRESS, PRESENTS, SHEET MUSIC, &c. The cost of a pupil for Board, Tuition in Literary Course, Washing, Lights, and Furnished Room, for ten months, $210. Extras FEW and MODERATE. Send for circulars and catalogue.

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For particulars, address, FRANCIS H. SMITH,
Superintendent.

New River RR. of Norfolk & Western.—The *Princeton Journal* is published at Princeton, Mercer county, W. Va., the county in which is located a large portion of the easily-approached-part of the Great Flat Top coal-field,—the present objective point of the New River branch of the Norfolk & Western RR.; from that paper of August 26 we gather the following items.—About a half-mile of the New River RR. has been graded by the new lot of hands that has been put on the road. The road will be broad gauge, and consequently the grading done by the convicts will have to be changed and made wider.—Quite a number of hands from Wyoming and McDowell counties have recently passed through town returning from the New River RR., failing to get employment because shanties and tools to work with were not ready.—Hands on the New River RR. can board themselves at about $6 per month, and thus clear about $25.—There is another boom in the stave business at Bluestone. Two lots of hands have recently been put to work.

Analyses of Van Buren Furnace Pig Iron, by J. Blodget Britton

	No. 1.	No. 2.
Graphitic Carbon,	0.311	3.166
Combined Carbon,	2.234	0.231
Silicon	0.326	2.215
Sulphur	0.041	Trace(?)
Phosphorus	1.107	0.167
Manganese	1.735	0.861
Iron, by difference	94.246	93.360
	100.	100.

No. 1 was "white" iron made from Clinton (No. V) ore from "Orndorf" and "Grindstone" banks.

No. 2 was "gray" iron made from Clinton (No. V) ores from "Grindstone" and "North Mountain" banks.

List of Nail Works in the Virginias.—We find the following list of the nail works in these states, in one of those in the U. S., in several of our exchanges:

In Virginia,—(1) Graham's Forge, Graham & Robinson, Graham's Forge, P. O., Wythe Co., 5 machines.—(2) Old Dominion Iron and Nail Works, Richmond, (works on Belle Isle, Henrico Co.), 76 machines.—Total number of machines 81.

In West Virginia,—(1) Belmont Nail Co., Wheeling, 111 machines.—(2) Benwood Iron Works, Wheeling, (works at Benwood, Marshall Co.), 24 machines.—(3) LaBelle Iron Works, Wheeling, 126 machines.—(4) Standard Nail and Iron Co., Clifton, Mason Co., 45 machines.—(5) Wheeling Iron and Nail Co., Wheeling, 110 machines.—Total number of machines, 416.

The Mail Facilities of Staunton, Va., our local habitation are excellent. The morning papers of New York city and those of Philadelphia, reach us at 4:40 in the afternoon of the same day; those of Baltimore, Washington and Richmond are in hand at 2:20 P. M. of the day they are issued. We have 10 daily mails by railway, and 6 by star-routes, except on Sunday, to and from all points north, south, east and west. *The Iron Age, Engineering and Mining Journal,* and *Coal Trade Review,* of New York. and *The American Manufacturer* of Pittsburg, reach us the day of their publication.

Miners' Wages.—*The American Manufacturer,* of Aug. 26, says: Hocking Valley miners are getting 70 cents per ton; Tuscarawas, 85 cents; Mahoning valley, 65 cents; and Pittsburg miners, 92 cents.

Mining and Civil Engineers.

W. H. DEWEES,
Carkin, Kanawha Co., W Va.,
Offers his services in the making of geological examinations, surveys or reports; in superintending the experimental development of mineral land and negotiating purchases. Agent for Pennsylvania Diamond Drill Co.

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Titles to Mineral and other Lands, in Virginia and West Virginia, carefully examined.

Thos. C. Elder. Wm. J. Nelson.
ELDER & NELSON,
Attorneys at Law & Real Estate Agents,
Staunton, Virginia.
Conference with parties proposing to purchase or sell real estate of any kind in Virginia respectfully solicited.
Best references furnished when desired.

Wm. A. Hudson. Wm. Patrick.
HUDSON & PATRICK,
Attorneys at Law,
Staunton, Virginia.
Practice in the Courts of Augusta and adjoining counties. Land titles a specialty. Refer by permission to N. P. Catlett, Cashier Augusta National Bank; Thos. A. Bledsoe, Cashier, National Valley Bank.

The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 9. } Staunton, Virginia, September, 1881. { Price 25 Cents.

The Virginias,

PUBLISHD MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor,

At 346 E. Main St., Staunton, Va.

Terms, including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising, per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

Entered at Staunton, Va., Post-office, as second-class matter.

Rogers' Va. Geological Reports.—Persons having copies of these reports for 1836, 1837, 1838, 1839 or 1840, that they will sell at a fair price, can find a purchaser by addressing Jed. Hotchkiss, Staunton, Va.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors,), complete, with index and title page, wil be sent, prepaid, to any address in the U. S., *on receipt of Three Dollars.*

Personals.—*Col. Marshall McDonald*, the Fish Commissioner of Virginia is at his home, Berryville, Clarke county, Va., preparing his annual report which he proposes to illustrate with a map.

Prof. Persifor Frazer has resigned as general manager of the Central Iron Co. of Virginia, on the James in Amherst county, and returned to Philadelphia.

Liverpool, .Eng., Mineral market.—From Geo. G. Blackwell's report of Sept. 22, 1881, we gather prices of articles named that may be of interest to some of our Va. owners of minerals. (Roughly, 4 shillings make one dollar.)—*Barytes* sulphate, lump, selected, 25s; first-class, 17s; prime white, ground, 87s, 6d; 1st quality, 72s, 6d, per ton.—*Chrome ore:* best, 120s to 130s per ton.—*China clay:* best 45s: good 35s., per ton.—*Asbestos:* Canadian, 700s to 800s; good fibre, 500s to 600s per ton.—*Blende* (Zinc sulphide), 60s to 70s, per ton. *Calamine* (Hydrous zinc silicate), 80s to 100s, per ton.—*Ferro-manganese*, 70 per cent, 350s; 50 per cent, 270s, per ton.—*Pyrites:* iron and cuprous, 6d per unit.—*Potter's lead ore*, 300s to 320s, per ton.—*Ochre*, Oxfordshire, 200s per ton.

American Institute of Mining Engineers.—The Autumn meeting of the Institute for 1881, will be at Harrisburg, Pa., beginning Oct.25th. The Secretary requests early notice of the papers members intend to read.—The Institute appears to have conceived a special fondness for The Great Valley; the Spring meeting was here, at Staunton, about the middle of its length in the U. S., from the northern end of Vermont to the middle of Alabama; the Autumn meeting will be in this same grandest and richest of valleys, 200 miles northeast from Stanton. It can afford to run in such a groove as this for some time, and we hope the meeting for next Spring will be about 150 miles southwest from Staunton, in this same valley, at Wytheville, so the members may have opportunity for seeing the great resources of S.W.Va. The Shenandoah Valley RR., which all that attended the last meeting must hold in perpetual remembrance, will by that time be completed to its Roanoke junction with the Norfolk & Western, so one may go by rail for more than a thousand miles through the Great Valley.

New River RR.—We noticed, in passing, a few days ago, that the track is graded from the junction with the Norfolk & Western at New River Bridge for some distance northward, and heard that the work of grading as far as Charlton's landing is progressing well. Able and experienced contractors have taken all of the construction of the road-way for the whole length of the line from New River Bridge down to East river and thence to Laurel fork of Bluestone, the border of the Great Flat-Top coal field.

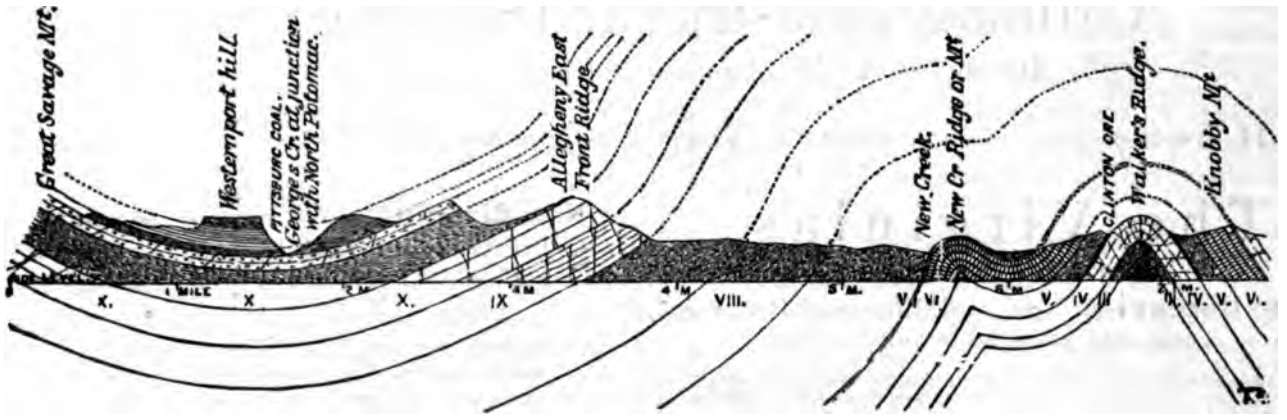
This railway, as we learn from maps of Chief Engineer Jno. Graham, jr., starting from New River Bridge, Pulaski Co., Va., and going northward, cuts off the two big bends of New river, passing Belle Spring at 3.5 miles and reaches New river again (the western bank which it follows all the way to East river) a half mile above the mouth of Back creek and nearly opposite the mouth of Poverty creek. It crosses Back creek at 5.5 miles; is in the gap of Walker mountain at 7 miles; Spruce run ferry at 9 miles. At 13 miles it is opposite New river, White Sulphur Springs; at 14 opposite Sinking creek, down which will come the Richmond & Alleghany RR.; at 17 is at Claiborne's ferry, opposite Little Stony creek; at 19 is opposite Walker's creek, up which a line has been located for the Va.-Ky.-&-Ohio RR. It is at Snidow's ferry at 21 miles; opposite mouth of Big Stony creek at 23; is within a half mile of Pearisburg at 26.5; at the mouth of Wolf creek at 30.5; at the ferry to Peterstown at 33; and at the mouth of East river, a half mile below where the Va.-W. Va. line crosses that stream, at 37 miles from New River Bridge. There the line now under contract leaves New river and runs up East river across the southeasterly side of Mercer county.

The line up East river passes Frenchville at 7 miles from New river; Spangler's, or 12-mile creek, at 14 miles; Bailey's near the head of East river, at 23 miles; runs across "the Sinks" to the summit, near Higginbotham's, at 24.5 miles; along Wright's valley to head of Pinhook creek at 26 miles; down Pinhook to Beaverdam creek, at 27.3 miles; and down Beaverdam to Bluestone river at 27.6 miles; this part of the line runs southwest from New river, the direction to that point being northwest. The line then follows down Bluestone, in a northwest course, crossing it twice near the 28th mile; crossing Brush fork at 31 miles, passing opposite Falls Mills P. O., Tazewell Co., Va., and Mud fork, at 31.5 miles; crossing Bluestone at 32.3 miles; Abbs' Valley spring branch, near Witten's, at 35.6 miles, and reaching the mouth of Laurel creek and the "big" 10 to 12 ft. coal bed, the "Nelson" and other beds of the Great Flat-Top Coal-field, at 36.5 miles,—the entire distance from the Norfolk & Western being 73.5 miles, from Roanoke 118, from Lynchburg 172, and from Norfolk 375 miles.

From Laurel-mouth the line will, probably run up Laurel some 2.5 miles to where the "big" bed goes under water level, and from the same point it will in all probability, run down the west side of Bluestone river, which borders Flat-Top Coal field on the east, crossing the tributary valleys of Mill, Simmons, Bell, Flipping, Crane, Widemouth, Delashmeet, Richland and Camp creeks, which cut across and into the coal measures at right angles to their dip, and give access to over 100 square miles of what promises to be one of the most valuable coal-fields in the United States.

Valley Products.—From Front Royal, Warren county, Va., during Sept., 1881, the Va. Midland RR. transported 100 bbls. of flour, 875 bush. of wheat, 215 bbls. of apples, 9,000 lbs. of dried fruit, 10 car-loads of spokes and 2 car-loads of cattle; besides, this town has another depot, that of the Shen. Val. RR., from which shipments are made.—*The Sentinel.*

Section from the eastern escarpment of Savage Mt. through Westernport (Md.) hill crossing to the W. Va. side of the North Potomac at the mouth of George's Creek, and continuing along the same S.25E. to the summit of Knobby Mt.
Scale 6000' to an Inch.



Second Geological Survey of Pennsylvania. *Constructed May 1881 by Prof. I. C. White.*

Notes on the Geology of West Virginia.—The Potomac Coal Basin.

By I. C. White, Professor of Natural History in the University of West Virginia.

(Read before the American Philosophical Society, June 17, 1881.)

A rectification of the Section made by Mr. Howard Grant Jones, M. S., and published under the title of "Notes on the Cumberland or Potomac Coal Basin, in Proc. A. P. S., No. 107, pages 111-116, read Sept. 17th, 1880.

The results at which Mr. Jones arrived concerning the duplication of No. XI along the North Potomac river, in his paper read before this Society last year, were so startling, and so much at variance from my own limited knowledge of the geological structure in that region, that I determined to investigate the question anew at the first opportunity. During May of the present year, in company with some members of my class in Geology at the University, we took a five days' excursion through the Piedmont Keyser region, and the present paper is the result.

As will be seen from the sequel, that part of Mr. Jones' section below No. XII is erroneous.

I find *no duplication of No. XI*, the "2,000' red shale," which Mr. Jones placed in No. XI, being Catskill, separated from the true No. XI by 1,150' of gray Pocono (Vespertine) (X) sandstone; his "(440' Lower Mountain Limestone" is *Lower Helderberg* (No VI); his "100' *Pocono sandstone" is the White Medina, more than* 10,000' *below the true Pocono.*

The line of section extends from Piedmont, Mineral county, West Virginia (and Westernport, Maryland, just opposite), south-eastward along the West Virginia side of the North Potomac to Keyser, (formerly New Creek, and 1.5 miles beyond to the summit of Knobby mountain ("Knobby.")

A reference to the accompanying figure will explain the structure of the rocks along the section line which is not far from 6.5 miles in length.

As is well known, the Cumberland, or Potomac Coal-Basin, lies in a trough of the Alleghany system with Savage mountain bounding its north-western rim, and Dan's mountain (the continuation of which, on the W. Va. side of the Potomac, is called the Alleghany Front Ridge) its south-eastern. The North Potomac, after flowing northeastward down this great syncline for many miles in West Virginia, receives the Savage river near the Maryland line, whence the combined stream flows eastward across the Basin to Piedmont, 2 miles below, and then, veering to the south-eastward, cuts squarely through Dan's Front Ridge mountain, continuing on across the upturned edges of X, IX, and VIII to Keyser, when, trenching through an arch of VII, and the upper portion of VI, across New Creek mountain (ridge), it again flows north eastward along the north-western slope of Knobby mountain to Cumberland.

From an inspection of the figure, it will be observed that the strata are almost horizontal in the vicinity of Piedmont and Westernport; that in going south-eastward they soon begin to rise quite rapidly, the lowest beds of No. XII coming up to the south-east at an angle of 12°, three-fourths of a mile below Piedmont. Nos. XI, X, IX, and VIII come up successively with constantly steepening dips until near the middle of VIII, the rocks are vertical; finally near Keyser the Oriskany sandstone, No. VII, comes up with a diminished dip, and arching over the anticlinal axis of New Creek mountain, barely dips down to water level on the North Potomac, making a very shallow and sharp syncline, since it immediately returns with a reverse dip of 65° to the north-west, which carries Nos. VII, VI, and V into the air over the Walker's ridge anticlinal, one-half mile south-east, to come down again on a south-east dip in the monoclinal range of Knobby mountain, whose crest is formed by the *Oriskany sandstone* (No. VII), and the underlying cherty layers at the top of the Lower Helderberg (No. VI), the varying composition and unequal hardness of which give rise to the peculiar topography that has given name (Knobby) to the range. A more general discussion of the data in this section is reserved for a future paper.

The intervals in the following section were measured directly down to 700' below the top of the Mauch Chunk red shale with one of Hick's compensated aneroids, the rest of the section being obtained by calculation from the observed dips and measured horizontal distances. The thicknesses thus arrived at are deemed rather under than above the truth, since a small percentage of error must necessarily enter into the construction of every such section.

1.	Massive sandstone, coarse grayish-white, most probably equivalent to one often found in Greene Co., Pa., 100' below the Waynesburg coal. It caps the summit of Westernport hill	25' 0"	Upper Coal Measures, XV — 268'
2.	Mostly concealed, but showing some outcrops of flaggy sandstone and shale	130' 0"	
3.	*Coal blossom*, large, Sewickly?	—	
4.	Concealed	90' 0"	
5.	Shale, grayish	2' 0"	
6	Pittsburg Coal at Westernport. Franklin Co.'s opening. Hill. — *Coal*, impure..0' 8"; Dark slate....4' 0"; *Coal*, slaty....1' 0"; Shale, grayish 1' 0" } Roof coal.....6' 8"; *Coal*, main bench, no partings, all good 10' 0"; Slate.....0' 2"; *Coal*, good....0' 0"; Parting.....0" ¼"; *Coal*, not mined 2' 0" } Bottom Coal 3' 0"	19' 0"	
7.	Dark slate	0' 6"	Barrens. (XIV.) — 600'
8.	Soft carbonaceous shale	0' 2"	
9.	Shales, drab	15' 0"	
10.	Sandstone, flaggy and shaly	25' 0"	
11.	Concealed	140' 0"	
12.	*Coal*, blossom. *Elk Lick?*	—	
13.	Concealed	100' 0"	
14.	*Coal*, blossom	—	
15.	Concealed	140' 0"	
16.	*Coal*	4' 0"	
17.	Concealed	35' 0"	
18.	Sandstone, massive, pebbly. Upper Mahoning	30' 0"	
19.	Concealed, with a *coal* reported 4' thick just below top of the interval	90' 0"	
20.	Lower Mahoning S. S., massive, visible	20' 0"	
21.	Concealed	10' 0"	

22. *Coal, Upper Freeport*.... Mr. Spangler's opening, Westernport hill.....	Coal.....2′ 0″; Shale, gray..1′ 0″; Coal.....2′ 0″	5′ 0″	Lower Productive
23. Concealed		10′ 0″	
24. Shale, bluish		10′ 0″	
25. *Coal*		2′ 6″	
26. Fireclay		2′ 0″	
27. Concealed		10′ 0″	
28. Sandstone, very hard		2′ 0″	
29. " shaly		5′ 0″	
30. Shales, sandstone and concealed		55′ 0″	
31. Dark bituminous shales		5′ 0″	
32. *Coal*, visible		2′ 0″	
33. Dark shales and concealed		10′ 0″	
34. Very massive sandstone, Lower Freeport		50′ 0″	268′
35. Shales, drab		0′–5′ 0″	
36. *Coal* Middle Kittanning / Darlington..... Mr. Spangler's opening in Westernport Hill	*Coal*, slaty....1′ 0″; Bony coal....0′ 8″; Coal, pyritous 1′ 4″; Slate, hard... 0′ ½″; Coal, best....2′ 6″	5′ 6½″	Coal Measures (XIII)
37. Fireclay, very sandy		3′ 0″	
38. Shales, with nodular *iron ore*		2′ 0″	
39. Fireclay, impure		4′ 0″	
40. Flaggy sandstone		20′ 0″	
41. Concealed		25′ 0″	
42. Fireclay, very sandy and impure		10′ 0″	
43. Flaggy sandstone		10′ 0″	
44. Sandy shales		15′ 0″	
45. Massive sandstone Piedmont / Homewood		20′ 0″	No XII, or Conglomerate
46. *Coal*		2′ 0″	
47. Dark shales, containing many fossil plants, *Pecopteris dentata, P. polymorpha, Neuropteris flexuosa, N. acutifolia, Odontopteris* sp.? and many other common *Coal Measure* forms; also many nodules of "Kidney" *iron ore*, all seen in cutting at Davis' bridge (Saw mill road) opposite Piedmont		45′	
48. Sandstone, hard, somewhat current bedded, inclined to be flaggy, weathering in holes, seen in the cliff to level of North Potomac, at Piedmont, just above the C. & P. R. R. bridge		40′ 0″	
49. Dark shales (coaly) and concealed		30′ 0″	
50. Sandstone, flaggy		10′ 0″	
51. Shale, dark olive		2′ 0″	
52. *Coal*		1′ 6″	
53. Fireclay, dark, sandy		12′ 0″	
54. Sandstone, flaggy, with *coal streaks*		10′ 0″	
55. *Coal*		1′ 6″	
56. Shale, with nodular *iron ore*		2′ 0″	451′
57. Shales and flaggy sandstone		40′ 0″	
58. Massive, very hard, grayish-white fine grained sandstone, with some small pebbles, exhibiting in its lower portion between the layers, at intervals of 2′ to 3′ a kind of imperfect crystalization, by which a vertical section through the layers much resembles along the bedding planes the large interlocking teeth of an animal. This peculiar structure was observed at localities 2 ms. distant, and seems to be characteristic of this stratum in the Piedmont region. Seen forming a long line of cliffs on the Maryland side of the Potomac, 1 mile below Piedmont, and also capping the summit of the Front Ridge Alleghany on the W. Va. side, 2 ms. below Piedmont		45′ 0″	Measures.
59. *Coal shale*		5′ 0″	
60. Concealed with some shale and flaggy S. S. visible		145′ 0″	
61. Sandstone, massive		10′ 0″	
62. Bituminous shale		10′ 0″	
63. Sandstone, flaggy		10′ 0″	
64. Sandstone, massive, whitish (base of XII)		20′ 0″	
65. *Coal*, seen at roadside along the Maryland shore of North Potomac, 1 m. below Piedmont		1′ 0″	Umbral (No. XI), or
66. Sandstone, drab		4′ 0″	
67. Fireclay and shale		3′ 0″	
68 Sandy shale		4′ 0″	
69. Shales, brown, containing *iron ore*		10′ 0″	
70. *Red shale*		10′ 0″	
71. Sandstone, flaggy, greenish-gray, with much shale		40′ 0″	
72. Concealed		40′ 0″	
73. Sandstone, somewhat massive, greenish-gray		20′ 0″	
74. Concealed, but showing occasional appearances of *red shale*, and very probably largely composed of that material		375′ 0″	852′
75. Sandstone, somewhat massive, but often inclined to be flaggy, greenish-gray; seen in cliffs along the B. & O. R. R. cuts, near the 205th mile post from Baltimore below Piedmont		130′ 0″	Mauch Chunk shales
76. *Red shales*		35′ 0″	
77. Shales, greenish, sandy		20′ 0″	
78. *Red shale*, to level of B. & O. RR. track at little run, 76 rods east from the 205th m. p. from Baltimore		10′ 0″	
79. Concealed		150′ 0″	
80. Limestone, gray, fossiliferous, containing *Spirifer keokuk, Athyris sub quadrata, Productus cora, Hemipronites crassus*, and many *Crinoidal* fragments		10′ 0″	Mount'n Limestone
81. Concealed, but probably containing several layers of limestone		90′ 0″	
82. Limestone, gray, massive		5′ 0″	
83. *Red shales* and concealed		140′ 0″	340′
84. Sandstone, coarse, brownish, visible		5′ 0″	
85. Concealed		50′ 0″	
86. Limestone, grayish-white, no fossils seen		10′ 0″	

87. *Silicious Limestone* (of Stevenson in Fayette and Westmoreland, Pa.), exhibiting a wavy or current bedded structure and giving forth a metallic resonance when struck with a hammer..... 30′ 0″ (No. XI.)

88. *Vespertine, Pocono*, or *No. X*, consisting of gray current bedded, mostly flaggy sandstones, no conglomerates seen, nor red shales; rising at an angle of 18°—20° towards the S. E. and extending along the B. & O. RR. for 58 chains, the lowest layers rising above RR. level 33 chains east from the 204th Baltimore m. p. Thickness about . . . . . 1,150′

89. *Catskill*, or *No. IX*, consisting of dark red shales alternating with red, and greenish gray sandstones, containing *fish remains*, but no molluscan seen; rising towards the S. E. at an angle of 25° at top and 35° where the bottom layers come up 7 chains west of the 203d m. p. thus making a vertical thickness of, say . . . . . 1,300′

90. *Chemung*, consisting of alternate layers of thin, olive sandstones, and shales, very fossiliferous, and perfectly exposed along the B. & O. RR. in vicinity of 203d m. p.; coming up towards the S. E. at an angle of 35°, and at the end of 10½ chains the dip is increased to 45°, thus giving an approximate thickness of Chemung down to this point of about 400′ (Rocks certainly 602′ Chemung. (VIII))

91. *Conglomerate*, composed of very thin, flat, rounded quartz pebbles, in a matrix of coarse rotten sand with numerous fossil shells imbedded, very forcibly reminding one of the Venango Lower (3d) Oil Sand; thickness . . . . . 2′

92. Chemung flaggy sandstones and shales continue rising at an angle of 45° for 16 rods further towards the S. E. all perfectly exposed, and very fossiliferous; thickness . . . . . 200′

93. Concealed, 13½ chains, at the end of which the strata are rising at an angle of 62° towards the S. E. thus making the intervening thickness about . . . . . 700′

94. *Conglomerate*, a gray, hard sandstone, containing numerous layers filled with flattish, white quartz pebbles 40′

95. As we go S. E. from this point toward Keyser, the rocks rapidly increase their dip to the N. W. and at ½ mile from the outcrop of No. 94, are vertical; continuing thus or even slightly bent over beyond the perpendicular to the end of 100 chains (1¼ ms) from No. 94. Exposures are rare in this interval, as there are seldom more than 5′—10′ exposed at any one locality, and these are in every case olive, and drab colored shales. The topography also shows that no hard nor massive rocks occur in this interval, since on entering it the mountain immediately breaks down to the S. E, giving a broad valley along the Potomac, bordered by gently sloping hillocks. The interval includes all the rest of No. VIII, whatever there may be of *Portage, Hamilton* and *Corniferous*, and its thickness cannot be less than . . . . . 6,000′

96. *Oriskany Sandstone* (No. VII), rises above the North Potomac nearly opposite the depot at Keyser, and arching up over New Creek ridge (mountain) forms the bold cliff at Queen's point, opposite Keyser, 400′ almost vertically above the river; a very coarse, brownish sandstone, filled with its characteristic fossils, *Spirifer arenosus, Rensaclaeria ovoides*, and *Platyceras ventricosum*; it comes down the river at the RR. cut a short distance east from Keyser, with a strong southeast dip, but immediately returning it comes up again with a strong N. W. dip (65°), and arching up passes in the air over the next anticline to come down again along the (monoclinal) crest of Knobby mountain ("Knobly".) Thickness. . . . . 75′

97. *Lower Helderberg* (No. VI); at top a gray silicious limestone, with several layers of flint 6′—10″ thick, interstratified for about 150′, then follow blue and gray layers of pure limestone richly *fotsiliferous, Strophomena radiata, S. rugosa Pentamerus pseudo-galeatus, Rhynchonella ventricosa, Spirifer macropleurus, Atrypa reticularis, Tentaculitus, ornatus, Leperditia alta*, besides numerous species of *Favosites, Zaphrentis, Stromatopora*, and *Chaetetes* being very abundant. Very fine *Trilobites* are also reported from some of the quarries, which from their (reported) size must be species of *Asaphus*. This is the limestone which was identified in H. G. Jones' section as the *Lower Mountain Limestone* of XI, and 440′ thick. My measurements make it much thicker, however; it is finely exposed along Limestone run one-half mile S. E. from Keyser; it makes the N. W.

slope of Knobby mountain all the way between Keyser and Cumberland, the upper silicious layers often forming the irregular crest of the same; its uppermost 300′ are also exposed under the great arch of Oriskany Sandstone at Queen's point opposite Keyser, where the North Potomac cuts through New Creek mountain. The fossils given were all seen in the upper portion of the formation. No attempt was made to subdivide the series, which consists of limestone throughout, the measurement of which south-eastward along Limestone run gave the horizontal distance through it 18 chains, with a N. W. dip of 63°, which would give a thickness of . . . . . 1,050′

98. A succession of shales, marls and thin shaly limestones, with occasional brown flaggy sandstones; near the centre of which occur very strong *salt springs* from which considerable salt was formerly manufactured, the whole representing the *Salina group* of New York. Thickness about . . . . . 350′

99. (*a*) Hard gray flaggy sandstone, 20′, then follows
(*b*) a succession of brownish sandy shales with a few thin layers of impure limestone near the centre, and two layers of *iron ore*, the one 6″ the other 12″ thick, and separated by 10′ of shales, 50′ below the centre; thickness about 300′. Then comes
(*c*) the main mass of the *Clinton fossil iron ore* 20′ thick, quite rich in iron, but entirely too siliceous; once shipped from the land of Mr. N. Alcaire on Limestone run by Uniontown, Pa., parties to Lemont Furnace and one or two in Pittsburg, but after a thorough trial condemned by them all as too siliceous.
(*d*) shales 40′ thick.
This whole group (*a, b, c, d*), and probably a portion of the overlying 350′ in No. 98, representing whatever there may be of Niagara (if any) and all of the *Clinton* (No. V); entire thickness (*a, b, c, d*) . . . . . 380′

100 *Medina Sandstone* (No. IV in part), seen forming the lowest rocks in the (anticlinal) halfway between New Creek mountain and Knobby range, the upper portion reddish brown to gray iron-stained sandstone, containing *Arthrophycus harlani* in great numbers, thickness 150′; lower portion an almost snow-white, very hard, fine-grained sandstone, some portions slightly streaked with iron, thickness 125′; finely exposed on Limestone run, one mile above its mouth where that stream cuts through the Walker's Ridge axis This is the stratum which Mr. H. G. Jones identified as the *Pocono*, or white sandstone of X, the 100′ sandstone with which his section ends (see Proc. A. P. S. Vol. XIX, No. 107, page 116). On the B. & O. RR., one mile west from Brady's Mills, 15 miles east from *Keyser, this white sandstone is seen in the RR. cut 100′ thick, and below it 500′ of drab, brown, and bluish shales ending in a flaggy sandstone at base.) Entire thickness of Medina at Keyser to base of white sandstone . . . . . 275′

SUMMARY.

Carboniferous.			
Upper Coal measures (XV)		268′	3,929′
Barrens (XIV)		600′	
Lower Coal measures (XIII)		268′	
Conglomerate measures (XII)		451′	
Mauch Chunk shale 852′ / Mountain Limestone 340′ (XI)		1,192′	
Pocono (Vespertine) (X)		1,150	
Devonian.			
Catskill (IX)		1,300′	8,717′
Chemung / Portage / Hamilton / Upper Helderberg / (Corniferous)	(VIII)	7,342′	
Oriskany Sandstone (VII)		75′	
Upper Silurian.			
Lower Helderberg Limestone (VI)		1,050′	2,555′
Salina / Niagara? / Clinton	(V)	730′	
Medina Sandstone 275′ / Medina shales * 500′	(IV) (in part)	775′	
Total height of section			15,201′

*Seen near Brady's Mills, 15 miles east from Keyser.

Note on Black-Band Iron-Ore in West Virginia.*

BY S. P. SHARPLES, S. B., BOSTON, MASS.

Having occasion a few weeks ago to investigate the subject of black-band iron ore in West Virginia, I was surprised at being met at the outset with a denial of its existence. One gentleman went so far as to offer one hundred dollars an acre for any land in West Virginia that contained a seam or vein of even a single foot in thickness, and when shown the ore, he acknowledged that it was genuine, but declared that it had been imported. That black-band does occur in West Virginia, is to-day well known to a number of persons. There is a seam on the Gauley river of about a foot in thickness of good ore, which I understand Mr. Lewis and others are making preparations to work. The great trouble with black-band ores as heretofore found in this country has been their limited extent. At Fort Washington, for instance, they had a very fine showing of ore, but it soon gave out.

It has also been asserted that the black-band ores of the Western Coal Measures were worthless in the furnace, and Fort Washington has been pointed out as an example of the fate of any one who should undertake to work them. But they have been successfully worked at Youngstown and in other parts of Ohio, and I am assured by old furnace-men from Ohio that there is not the slightest difficulty in working them if properly managed.

The deposits to which I wish to call the attention of the Institute, are situated about nine miles from Charleston, West Virginia, and lie at the head of Davis creek. This bed has not been fully explored yet, and has not been worked. Only one drift has been driven into it, and that only about 60 feet. But the bed has been found and identified over a tract of some 1,500 acres.

This ore is compact, and resembles in appearance Cannel shale. Various analyses have been made of it at different times since 1871, when it was first discovered, with about the following results:

For purposes of comparison, I give also an analysis of the Helen ore, Hocking Valley, Ohio, and one of a Welsh ore:

	Davis Creek.	Helen.	Llanelly.
Silica	3.60	4.93	7.20
Phosphorus	.25	.87	.295
Sulphur	.41	1.07	.26
Metallic iron	31.46	36.43	33.68
ROASTED ORE.			
Metallic iron	64.00	50.80	56.00

The ore loses rather more than half its weight in roasting.

The bed appears to hold its own over the area of which I have spoken, and to run from 4 to 5 feet thick.

The analysis of the black-band ore on Gauley river is almost identical with the above.

*From Trans. Am. Inst. of Mining Engineers.—Read at the Staunton, Va, Meeting, May, 1881.

The Coking Coal Lands at Fayette station of the Ches. & Ohio Ry, which Mr. G. M. Blume offers for lease at the very low royalty of 7 cents a ton, in our advertising columns, contains the noted Nuttallburg coal bed, already opened, this property adjoining the Nuttallburg. This New river coal has acquired a reputation second to none for metallurgical, steam and domestic purposes, and a good opportunity is offered by this property to any one that would embark in mining it immediately on the line of the railway. We commend this to the attention of coal operators.

Earnings of Norfolk & Western RR.—A statement from Treasurer Wm. G. MacDowell shows that the approximate gross earnings of the Norfolk & Western RR. for Sept., 1881, were $212,863, an increase of $3,417 over the same month in 1880.—Its approximate gross earnings for the 12 months ending September 30, 1881, were $2,203,006, an increase of $181,907 over the same period in 1880,—an increase of 9 per cent.

The Local Passenger rates and Local Freight rates (reduced June 1st and August 1st, 1881, respectively, in order to further the local interests of the road) being about 25 per cent. lower than in September, 1880, the above increase in gross earnings is equivalent to an increase of 36 per cent. in the volume of business over that of September, 1880.

Sale of W. Va., timber-lands, etc.—The statements of the lumber traffic of two of our great railway lines, the Chesapeake & Ohio and the Norfolk & Western, for July and August (which we publish in this issure of THE VIRGINIAS) compared with those we have previously published, show an interesting increase in this important industry in these states. One of the causes that has lead to this improvement is the influx of northern lumbermen to our timber regions, an influx we are pleased to see going on.

In this connection we learn from Mr. Wm. L. Rawson, the general agent of the lumber department of the C. & O. Ry, who is giving attention and encouragement to the development of the timber besiness along the line of that road, of the consummation, through his efforts, of the largest sale of valuable timber lands hitherto made in West Virginia. The lands sold are about 15,000 acres of selected white pine timber, located mainly in Pocahontas county, but partly in Greenbrier, all on the waters of Greenbrier river by which an outlet for the timber is had to Ronceverte, on the C. &. O. Ry, where the mills are situated for converting the logs floated down the Greenbrier into lumber.

The stumpage of white pine on these lands is estimated to be 100,000,000 feet. The purchase includes also the valuable mill site at Ronceverte, and the franchises of the St Lawrence Boom & Manufacturing Co. The price paid for these properties was $109,000. The purchasers are Messrs. Camp, Kinports, Notley & Driscoll, all practical lumbermen from Indiana county, Penn., men who have means, experience and energy to successfully conduct the business they have undertaken in W. Va. They have taken possession of their purchases and are now making further improvements in the channels of Greenbrier river and of its Anthony's creek branch, so logs can be more easily run down those streams. They are now cutting irom 3½ to 4 million feet of white pine, on Anthony's creek, which they will float out during the coming season, and also a considerable quantity of long timber to be rafted down the Greenbrier.

The officers of this re-organization of the St. Lawrence Boom & Manufacturing Co., are John T. Driscoll, president; James Kinports, vice-president; and E. H. Camp, treasurer. All the members of the company will locate in W. Va. Mr. Camp ha charge of operations at this time.—We wish these gentlemen great success. West Virginia is one of the best timbered states in the Union, and we are quite certain that good lumbermen having a sufficiency of capital, energy and timber-handling sense cannot fail to do well there.

Our railways need branches into the great forests, for the best timber lands are not on the main lines. The Norfolk & Western has shown the usual good sense of its management in extending a branch, by way of New river, into the finely timbered Flat-Top region of Mercer and adjoining counties, and it and the Chesapeake & Ohio would act wisely if they would extend branches, or aid those that would do so, into the vast forests on the head-waters of Coal and Gauley rivers, and of Cabin, Paint, Loup and other creeks, all tributaries of the Great Kanawha, and up Greenbrier and Bluestone rivers of New river.

Southern Enterprise.—In carrying the Atlanta Cotton Exhibition to a successful issue, the South has, for the first time, shown its earnest desire to go to work with a will. The awakening spirit of enterprise will, we trust, be carefully fostered and generally encouraged, and it is to be hoped that the movement already inaugurated for developing the enormous natural resources of the Southern States will grow in strength rapidly. With expanding local markets, and the aid of capital from other quarters, the mineral wealth of the South, its coal-fields, iron-ore deposits, and veins of base and precious metals will no longer lie idle, but will contribute to the wealth and resources of the country. Let the business men of the South take the helm.—*Engineering & Mining Journal, Oct.* 8, 1881

Richmond, Va., metal market.—Asa Snyder, metal etc dealer, 1008 Cary st. Richmond, Va., under date of Oct. 3rd writes us: This market is very firm. Really prime No. 1 foundry pig iron is difficult to obtain, an l has advanced this week $1 per ton. Bar iron has advanced ¼ of one cent a pound. All of our manufacturers of wrought and cast iron work are full of orders. This is one of the busiest periods in the history of this city.

Metal and Mineral Traffic of Norfolk & Western RR.

Auditor E. E. Portlock has kindly furnished THE VIRGINIAS the data, compiled from the books of the company, from which the following statements, concerning the Metal and Mineral Traffic of the Norfolk & Western RR., for the months of July and August, 1881, have been prepared.—The quantities given are in tons of 2,000 pounds.

The Pig iron from Virginia, moved, was 2,836 tons, 1,664 in July and 1,172 in Aug.;—80 to Boston, 12 in July and 68 in Aug.;—34 to New York in July;—949 to Baltimore, 495 in July and 454 in Aug.;—365 to Philadelphia, 224 in July and 141 in Aug.;—28 to Norfolk in Aug.;—38 to Petersburg, 11 in July and 27 in Aug.;—36 to Lynchburg, 25 in July and 11 in Aug.;—655 to Richmond, 543 in July and 112 in Aug.;—11 to Rich. & Danville RR. in Aug.;—640 to Southern States, 320 in July and 320 in Aug.;—From beyond Bristol came 244 tons, 40 in July and 204 in Aug.; making the entire movement 3,080 tons, 1,704 in July and 1,376 in Aug.

The Iron ore, from Virginia, moved, was 426 tons, to Lynchburg, 205 in July and 221 in Aug.

The Zinc ore, from Va., moved, was 12 tons to New York in July; from beyond Bristol 15 tons were brought in July; total movement, 27 tons.

The Zinc spelter, from Va., carried, was 11 tons in Aug. to New York; from beyond Bristol 12 tons were brought; total movement 23 tons.—Recently 70,000 pounds of the pure spelter made by the Bertha Zinc Co. at Martin's, Va., were purchased by the U. S., and sent to San Francisco for use in the mint there.

Of Copper ingots 52 tons; 21 in July and 31 in Aug., were sent to New York: they came from Ore Knob, N. C.

Barytes:—from Va. 703 tons, 291 in July and 412 in Aug., were transported;—477 to Boston, 175 in July and 302 in Aug.;—221 to Philadelphia, 113 in July and 108 in Aug.;—5 to Richmond, 3 in July and 2 in Aug.

Limestone:—from Va. 842 tons, 155 in July and 687 in Aug., were carried to Lynchburg.

The Plaster movement from Va., was only 19 tons to way stations, 9 in July and 10 in Aug.

Of Salt from Va., 2,378 tons, 809 in July and 1,569 in Aug., were transported;—170 tons to way stations, 5 in July and 165 in Aug.;—2,208 tons, 804 in July and 1,404 in Aug., to Southern States.

The Coal, from Va., moved, was 2,287 tons, 734 in July and 1,553 in Aug., to way stations.—From beyond Bristol came 17 tons in July.

The Marble moved from Va., was 9 tons, 4 in July and 5 in Aug;—to way stations 2 in July and 3 in Aug.;—to Southern States 2 in July and 2 in Aug.—From beyond Bristol 638 tons, 301 in July and 337 in Aug., were brought, making the whole movement 647 tons, 305 in July and 342 in Aug.

The Lime traffic from Va. was 540 tons, 207 in July and 333 in Aug.;—to way stations 22, in July 7, in Aug. 15,—to Rich. & Danville RR. 296, in July 110, in Aug. 186;—to outside lines, via City Point, 222 tons, 90 in July and 132 in Aug.

The Manganese movement was 551 tons, 175 in July and 376 in Aug., all from beyond Bristol.

The aggregate movement from Va. was 10,115 tons, 4,111 in July and 6,003 in Aug. The destinations of this were:—to Boston 80 tons, 12 in July and 68 in Aug.;—to New York 586 tons, 242 in July and 344 in Aug.;—to Baltimore 949 tons, 495 in July and 454 in Aug.;—to Philadelphia 586 tons, 337 in July and 240 in Aug.;—to Norfolk 28 tons in July;—to Petersburg 38 tons, 11 in July and 27 in Aug.;—to Lynchburg 1,304 tons, 385 in July and 919 in Aug.;—to way stations 2,503 tons, 757 in July and 1,746 in Aug.;—to Richmond 660 tons, 546 in July aud 114 in Aug.;—to Richmond & Danville RR. 307 tons, 110 in July and 197 in Aug.;—to outside lines via City Point 222 tons, 90 in July and 132 in Aug.;—to Southern States 2,852 tons, 1,126 in July and 1,726 in Aug.—From beyond Bristol came 1,477 tons, 560 in July and 917 in Aug.

Va. ore in Pa.—The Charlotte Furnace at Scottdale is receiving ore from Lynchburg, Virginia, over the Baltimore & Ohio road. A number of loads passed through town during the week. The ore looks to be of a rich quality.—*Keystone Courier, Oct.* 7, 1881.

The Iron & Steel Association of Virginia.—We paid a visit on the 30th instant, to the scene of the operations of this company, near Goshen, on the Chesapeake & Ohio Ry., to note the progress made in the construction of its great furnace, one that when completed will not only be the largest in the Virginias, but also, judged by heating surface of stoves, the largest in the United States, and to see the developments of its extensive plans.

This Association, an English one, having its headquarters in London, has put up $1,500,000 for the purchase of about 4,000 acres of iron ore lands, the Brushy-North Mountain ranges and valleys of the old California furnace property, near Rockbridge Alum Springs, and of the Abrams' farm of several hundred acres, nearly 300 acres of which are of the alluvial plain of Big Calf-pasture river, near Goshen station of the C. & O. Ry., and for a plant for two blast-furnaces each having a capacity for the production of 150 tons of iron a day.

We found the road bed graded for a double track, standard gauge railway 1½ miles long, from the C. & O. at Goshen to the furnaces, and one track completed and ready for use. From the furnaces a 36 inch narrow-gauge railway will extend, for 12 miles, southwest up Bratton Run valley, to the iron mines, about 400 ft. more elevated than the furnaces,—a short extension across a divide would take this road to that of the Longdale Iron Co., of the same gauge, and thus make a "loop" line of the C. & O. from Goshen to Longdale depot. Two-thirds of this narrow-gauge road is graded, and this fall it will be completed to the mines. A third rail laid on the standard-gauge road will extend this line to the C. & O. Already three locomotives, two broad- and one narrow-gauge have been engaged, two of them in England and one in Pittsburg.

At the mines from 15 to 20 men have been engaged in making test drifts, etc., in the 20 to 60 ft. thick beds of Oriskany (No. VII) iron ores, and in the 14 inch bed of red-shale, (No. V.) ores of Brushy Mountain. Ten double, two-story, neat and comfortable dwelling houses have been erected near the mines.

At the furnace town the heavy, sandstone foundation walls, about 10 ft. high, for one of the casting houses, a building 80 ft. by 155 in size, are completed, and the work of rearing the brick superstructure on the foundation will begin at once. Over two million bricks, made on the spot, are now ready for use, and a half million more will soon be ready, The sandstone foundation for one of the furnace stacks, which will be 20 ft. bosh and 80 ft. high, laid solid in cement, some 10 ft. in thickness, is nearly done, and hands were excavating for foundations for the three Siemens-Cowper stoves, each 25 ft. by 60, the largest ones in the United States, having together 210,000 square feet of heating surface. Massive well walls are finished on the margin of the Big Calf-pasture from which an ample supply of water will be drawn. The chimney stack will be 135 feet high. A dozen or more neat and comfortable houses for workmen, on the second terrace of the valley, have been completed, and a large boarding house and other dwellings are under way. The buildings completed are of wood, but brick will be the material used hereafter.

The largest size standard blowing engine, 48x84, has been engaged from McIntosh, Hemphill & Co., of Pittsburg.

About 500 men are now at work, 250 on railway construction and 250 on furnace plant, &c.; the wages paid average about $1.10 a day, A number of teams are employed in hauling sandstone (No. IV) for foundations from the adjacent Knob. Mr. W. N. Page, the financial agent or general manager, was in place, giving prompt and efficient direction to the varied affairs of the association; he has already gathered here a staff of excellent assistants. Mr. E. Shepard is the engineer in charge of construction; he performed the same duty at Low Moor.

The Hawks-Nest Coal Co., of which Mr. W. N. Page is also the manager, is composed in part of the same persons as the Iron & Steel Association of Virginia, and from it will be obtained coke for the furnaces of that association. Contracts have been made and the foundations are being built, 1000 yds. of masonry being already laid, near Hawks-Nest station of C. & O. Ry., for 80 of Soldenhoff's Improved Coppee coke ovens, M. Soldenhoff, himself, a Belgian, having contracted to construct these ovens, under his personal surpervision, guarantee ing that 95 per cent of the carbon in the coal used shall be saved in the coke made. Over 3,000 of these ovens are now in use in England, and also large numbers in Belgium and elsewhere in Europe. Each oven will yield twice as much coke as a beehive oven and its cost will be only about 35 per cent more. They will be made of Scioto Star fire-brick.

About 380 tons of coal are now shipped daily (when the C. & O. can furnish cars) from these mines, with one locomotive. Some 75 miners are now working, getting 40 cents a ton for mining. A double track has been laid on the siding and new tipples have been erected recently. The drift in the 11-ft bed mined by this company will next year have gone through Gauley mountain to its Rich creek side, as it is now within 1,000 ft. of that outcrop.

Mason County, W. Va.,—its Coal Mines, etc.—Mason county fronts on the Ohio river for 46 miles; the Great Kanawha for 17 miles, runs through the county from southeast to northwest and divides it into two nearly equal parts. It is 25 miles from the mouth of the Kanawha up the Ohio to the northern corner of the county on that river, and 20 miles from the same point down the Ohio to the southern corner of the county on that river. It has no railways at this time, depending on the Kanawha and the Ohio for transportation, no part of the county being more than 15 miles from navigable water, but the prospect now is good for its soon having two railways across the county, one on each side of the Kanawha, an extension of the Chesapeake & Ohio on the south side and of the Richmond & Alleghany on the north side, both to the Ohio at Kanawha-mouth, and a third road, one from Wheeling and Parkersburg, along the Ohio to the same point. The work of grading the Richmond, Alleghany & Ohio road is now in progress and engineers are locating the other roads named.

The four leading coal mines of this county are the *Camden* mine at Camden, owned by J. N. Camden & Co., and operated by the Consolidated Coal Mining Co., W. H. Fogel, Supt., West Columbia P. O., general office N. W. corner Walnut and Second streets, Cincinnati, Ohio;—the *Clifton* mine, at Clifton, owned and operated by the Ohio and West Virginia Mining and Manufacturing Co., H. G. Nease, Secretary, Clifton;—the *Sterling* mine, near Clifton, owned and operated by the Sterling Coal Co.;—and the *Hartford City Coal and Salt Company's* mine, near Hartford City, operated by G. W. Moredock. These mines are in the "Pomeroy" or "Pittsburg" coal bed of the Upper Coal Measures, mining from 4 to 4.5 ft. of thickness. During the 10th-Census year these mines furnished about 89,000 tons of coal, valued at near $111,000, or about $1.25 a short ton. Some 300 persons were employed at these mines, and the wages paid them were some $91,000, or nearly $1.03 per ton of coal mined; 19,300 pounds of powder, valued at about $2,500, or near 13 cts. per pound, were used, costing per ton of coal mined from 3 to 11 cents, averaging somewhat over 5 cents worth to the ton of coal mined. Of horses 7, and of mules 64, all valued at $5,675, or an average of $80 each, were used in connection with these mines. Over $4,000 were expended for "materials used," or nearly 5 cents per ton of coal mined. The capital invested in these and employed in working them was nearly $415,000, or $4.66 per ton of coal mined. Part of the coal from these mines is shipped, by the Ohio, to Cincinnati, and Aberdeen, Ohio; Maysville, Augusta, and Vanceburg, Kentucky; and to other towns on the Ohio; the remainder is consumed by the local salt furnaces, nail works like those of the flourishing *Standard Co.*, at Clifton, and other manufacturing establishments. The capacity of the mines named is about 140,000 tons a year. Sales are made both by the long and the short ton and by the bushel of 80 pounds.

Maury (Resources of W. Va.), states that in 1875 there were 9 coal mines in this county in operation, producting 301,000 tons, 101,000 of which were consumed in the local salt furnaces. He says the thickness of the bed at Hartford City is from 5 to 6 ft.

The analysis of the Hartford City coal, by C. E. Dwight, gave coke 52.19 per cent, volatile matter 47.31, water 3.43, ash 5.31, sulphur in the coal 1.57 and in the coke 1.93.

The Vulcan Iron Works, of Bruce & Archer, mainly engaged in nut- and bolt-making, Richmond, Va., burned down June 1st, 1880, are again in full blast, working night and day, in a fine brick building.—*The State.*

Notes on the Hard-splint Coal of Kanawha Valley.*

BY STUART M. BUCK, COALBURG, WEST VIRGINIA.

The term "splint" seems to have been adopted to describe the fracture of the hard bituminous coals of West Virginia.—It is not a scientific name, but rather a trade term, and does not indicate a correspondence with English splint. At present it is a popular word, and is very loosely applied to coals of various qualities, in the desire to improve their sale. The Kanawha splint is distinguished by its hardness, dull lustre, coarse fibrous structure, its purity, and especially its resistence to atmospheric influence. It kindles very readily, burns with a bright flame, but does not cake, so that a lump when half consumed, may be broken by a slight blow in its plane of cleavage, though it will resist a strong blow in any other direction. I have seen pieces that have been exposed to frost and sun for a dozen years, and that are now as firm, and ring as clearly when struck, as though freshly mined.

The principal splint vein worked on the line of the Chesapeake & Ohio Railway, is that known as the *Coalburg seam.* It has been regularly mined for the last seventeen years. The Kanawha & Ohio Coal Company began mining it, on their property at Coalburg, in 1864, shipping by river till the opening of the railroad, in 1872.

The Coalburg vein, worked at Coalburg, East Bank, and Paint Creek, is about 450 to 500 feet above the track of the Chesapeake & Ohio Railway, and 150 feet below the Flint Ledge, which is a stratum of gray, blue and black flint, running very regularly throught the country, and constantly referred to as a base-line for the location of different veins.

The section of the Coalburg vein is as follows, counting upwards from the slate floor :

A. Hard splint, bottom bench.

B. Middle bench, splint mixed with softer coal to some extent.

C. Bone or "niggerhead," sometimes split by a thin layer of coal.

D. Top bench of hard splint.

The whole thickness of the coal, including the bone, is 3′ 8″ to 4′ 6″, and, counting the bone as belonging with the top bench, the three divisions are of nearly equal thickness.

The niggerhead is from six to eight inches thick, and as it does not separate very freely, an additional loss of two inches of coal is frequently incurred. Constant watching is required to prevent the niggerhead from being loaded with the coal, as it is so similar in appearance to the coal, that in a dim light, or when coated with dirt, it can only be distinguished by its greater weight.

The roof of the Coalburg vein is usually a heavy dark slate, varying much in character ; sometimes so strong as to require little or no timber in a room of 24 to 30 feet wide, and again so bad that no posting will hold it in an eight-foot entry. At times the roof slate runs out, and is replaced by the overlying sandstone, which is remarkably strong, so that usually no timbers are required in rooms of ordinary width ; even after the pillar have been drawn, the roof has been known to stand for a long time, unsupported, over a space 40 yards square. This character of roof has its disadvantages, as it makes the drawing of pillars more dangerous. The sandrock will hold up for a long time, but then it is liable to fall with little warning, and in such masses as to crush down all supports, and break even beyond the face of the coal.

The bottom slate, forming the floor of the vein, varies from half an inch to four feet and upwards, and is underlaid by a seam of soft bituminous coal, one foot to three feet thick. This soft coal is of little value for fuel, but if washed, would make excellent coke. When the bottom slate, which divides the splint and the soft coal, does not exceed three inches in thickness, and there is any parting in the soft coal, the bearing-in or mining, is made below the slate, so as to avoid wasting the more valuable splint coal, and to gain additional height.

Theoretically and geologically, the coal seams of the Kanawha valley dip very regularly to the northwest, at the rate of about fifty feet to the mile ; but practically, the coal lies in basins, and the dip is so frequently reversed, that the question of drainage is often a very annoying problem. There is not sufficient dip to concentrate the water, and it is impossible to tell in advance what the dip will be. This adds to the difficulty of satisfactory and economical mining, owing to the danger of water whenever the roof is broken either by drawing pillars, or by long-wall work. The water finds its way through the swamps as they are called, and drowns out the workings at a distance.

The splint coal is prepared for market over an inch and a quarter screen, and the nut coal is cleaned over a half-inch screen. The miners are paid by weight for the screened coal ; the bushel of 80 pounds is the unit, for which, at present, the price of digging is 3½ cents, or 98 cents per ton of 2240 pounds. On the railroad the coal is sold by the long ton, but in the river markets it is sold by the bushel of 2,688 cubic inches, measured in the barge. These barges carry from 8,000 to 10,000 bushels and are usually 24 by 130 feet, with 5 to 6 feet draft

Splint coal is especially adapted for use as domestic fuel in open grates, and is valued by shippers and dealers for its ability to resist breakage. It is a good gas coal, giving tests fully equal to the Penn and Westmoreland, but it cannot be mined to compete in price with the softer coals.

It is a favorite locomotive coal, giving results superior to the Youghiogheny, and is an excellent coal for blast-furnace use. It can be used without coking, and its purity is vouched for by the fact, that in 1873-'74 it was used in making so-called "charcoal" pig iron, and when it did not exceed two-thirds of the fuel charge, the result was said to be good.

In the preparation of the splint, as well as of the softer varieties of bituminous coal, the aim is to avoid breakage in every possible way, so that the coal may reach its market in an attractive form. The operator grudges every foot of fall in the screening and loading of his coal on the railroad or at the river, but when coal is shipped by sea it is so roughly handled in loading and discharging vessels, that all previous efforts are rendered vain. There is great need of some decided improvement in this respect.

There are a few points on which I would like to invite some discussion :

1st. The probability of any relation between the topography of the country, and the character of the coal-seams 100 and 300 feet below the surface. The most experienced miners claim that a rich mountain top will be underlaid by a good and regular seam of coal, and on the contrary, that any sharp, rocky point or ridge is likely to indicate a "horseback or "fault" below. They also look for a "swamp," in every case, near the crop of the coal. I have not been able to trace any foundation for these claims, either in fact or in theory.

2nd. The relation between splint and cannel coal. The "Coalburg seam," now being worked directly fronting the Kanawha river, is supposed to be the same vein as that opened five miles back, on Paint creek ; but in the latter place it has become thicker, and part of the splint is replaced by cannel.—The total thickness is about 10 feet, of which 2 to 3 feet are cannel ; the singular part of it is that in one place the cannel occupies the centre of the vein, while at a distance of a few hundred feet, it appears near the bottom. Pieces of coal may also be found which show nothing but splint upon one side, while the other is banded with cannel.

3d. I have noticed a peculiar occurrence of coal in the sandrock roof of the vein. In one place, where a fall occurred, exposing a section of the sandstone, it showed a number of blocks of coal imbedded in the rock ; not stringers or layers, but angular blocks of splint, as well defined as though they had been picked off from a coal car and placed in the sand while it was being deposited. I have also had two singular specimens brought to me from the slate immediately underlying the splint. One was a piece of milk quartz, and the other of flint, both rounded, each of about ten pounds weight.

4th. Has it been determined under what circumstances the coal known as "Dant" or "Mother Coal" was deposited ?"

*From Transactions of Amer. Inst. of Mining Engineers. Read at the Staunton, Va. Meeting, May, 1881.

Value of Pa. Coal-lands—The *Keystone Courier*, of Connellsville, Pa., of Oct. 7, 1881, states that E. K. Hyndman and James Cochran have recently purchased 1,951 acres of bituminous coal lands, at the mouth of Jacob's creek, fronting about a mile on Youghogheny river, at $200 per acre. This land contains two beds of coal, one 4 ft. thick and one 9, lying 50 feet apart.

The Potomac Coal Basin.—The illustrated paper on the "Potomac Coal Basin" (which by the active courtesy of the author, Prof. White, seconded by that of Prof. Lesley, Secretary of the Am. Philosophical Society, we are enabled to present to our readers so soon after it was read)—is a very valuable contribution not only to the geology of W. Va., but that of all the Apalachian and Trans-Apalachian region of the Virginias and adjacent states. Its careful measurements, many of them in detail, of the different beds of the rocks exposed in the section made by the North branch of the Potomac in its first great southeastward bend, where it breaks through Westernport hill, and Alleghany East Front, New Creek, and Walker ridges and Knobby mountain, rocks aggregating over 15,000 feet in thickness and extending, geologically, from the top, or very near it, of the Coal Measures, No. XV, down through the underlying formations to IV and including it in part, will be of very great value to every investigator of the structure of our mountains, whether for scientific or economic purposes. We have present use for all "notes" like these by Prof. White and like those by Prof. Fontaine on the New river rocks, which are published on pages 28 and 29 of our 1880 volume, and those of Prof. Stevenson in S. W. Va., published on pages 22, et seq., of our current volume.

As an illustration of the use of such, to the uninformed apparently useless, details, we may state that just now we are working, with the aid of pick, shovel and barometer, to ascertain the number, thickness and character of the wonderfully developed coal beds of the Great Flat Top or Bluestone coal-field, one where the coals are (most probably) those of the Virginia Lower Measures, No. XII, exposed in the eastern face of the Great Carboniferous escarpment, locally called Great Flat-Top mountain, in Mercer county, W. Va., and Tazewell county, Va. In this work we find valuable guides in reference to the location of coal beds, etc., in the "notes" of Stevenson on the same escarpment some 90 miles to the southwest, in those of Fontaine, some 30 miles, and in those of White about 180 miles to the northeast, in the same escarpment.

The following extract from a recent letter by Prof. Edward Orton, of the Ohio Geological Survey, to the *Ohio State Journal*, illustrates further the use of such knowledge:—"The name and number of a coal seam and its place in the series would seem to many persons unimportant questions, if only the seam has good thickness and approved quality, but it is found by practical experience that coal seams have individual and distinguishing marks of various kinds. In particular, one is persistent in thickness and extent and another is inconstant and uncertain—one is quite uniformly good, another will exhibibit great changes of quality in a short distance. Thus it comes to pass that the promise of a seam is very closely connected with its name and number. A showing of coal in a new field belonging to a certain horizon would be counted of great value, while an identical section, if of another seam, would be passed by without interest or confidence. The former would give fair warrant for expecting a field of good proportions, while the latter would occasion no surprise if it should shrink to a black mark in the next section."

Prof. White —who as an Assistant Geologist of the Pa. Survey is now working up the geology of Pike and other N.E. corner counties of that State—writes us, under date of Sept. 7, that the Regents of the University of W. Va., have very kindly released him from work during the Fall term, so that hereafter he will teach in the University during the Winter and Spring terms, and so he will have 6 months of the year to devote to practical geological work. He will be in the field on the Pa. Survey for these 6 months during the years 1881, 1882 and 1883,—after that he hopes to be able to devote more attention to the geology of his native state, West Virginia. The Regents have also granted him the privilege of taking the "seniors" of his classes into the field, in May of each year, for 3 or 4 weeks, and in that way he will be able to do valuable geological work (such as that we comment on) in W. Va., and at the same time educate the young men of that state to independent work in Geology.

Lumber, etc., Traffic of Norfolk & Western RR.

From official data, furnished THE VIRGINIAS by Auditor E. E. Portlock, we compile the following statements of the lumber, timber, etc., traffic of the Norfolk & Western RR. for July and August, 1881,—continuing the movement for the year from page 119 of our August number.—The quantities are it 2,000 lbs. tons.

Destination.	Lumber.	Logs.	Staves.	Wood.	Total.
Boston.....	291	97	.....	.....	388
New York.....	332	1,258	.....	.....	1,590
Baltimore.....	12	61	.....	.....	73
Philadelphia,.....	24	11	.....	.....	35
Norfolk,.....	1,428	167	679	9	2,281
Petersburg.....	1,033	80	45	1,157	2,315
City Point.....	60	759	.....	.....	819
Richmond.....	515	106	106	.....	621
Lynchburg,.....	429	.....	.....	18	447
Va. Midland RR....	26	167	.....	.....	191
R. & Danville RR...	20	.....	.....	.....	20
Way Stations.....	605	72	.....	62	739
Totals,.....	4,773	2,672	828	1,246	9,519
From Tenn. & S.....	1,448	796	623	.....	2,867
Tons moved.....	6,221	3,468	1,451	1,246	12,386

Estimating 500 ft. board-measure to one ton, the 12,386 tons moved would be equivalent to 6,193,000 B. M. feet.

The progress of the movement in 1881, up to Sept. 1st, is shown in the following:

1881.	Lumber.	Logs.	Staves	Wood.	Total.
July & Aug.	6,221	3,468	1,451	1,246	12,386
Jan. to Sept. 1.	15,185	6,724	2,040	5,739	29,688
Total to Sept. 1,	21,406	10,192	3,491	6,985	42,074

This shows a very large increase in each item except wood; in the case of logs and staves half as much was moved in July and Aug. as in the preceding 6 months.—There is great activity in the movement of black walnut logs from all along the Great Limestone Valley and from the limestone valleys west of it, especially from Saltville, from which great numbers of very fine ones are now being shipped.

The monthly movements, to continue our tables in detail, were:

		Lumber.	Logs.	Staves.	Wood.
July	Va.....	2,671	1,866	356	827
	Tenn. & S.....	664	325	178	...
Aug.	Va.....	2,102	806	472	409
	Tenn. & S.....	784	471	445	...

In passing over this railway recently, we noticed quite an accumulation of lumber, logs, etc., all along, but the exceptionally warm and dry weather, that has characterized the year so far, has doubless affected the volume of this traffic.

The Lumber Traffic of the Ches. & Ohio Ry. for July and August, 1881, and for same period in 1880, in 10-tons of 2,000 lbs each car-loads - that from which revenue was derived —prepared for THE VIRGINIAS by Gen. Agt. Wm. L. Rawson, of C. & O. Ry. Lumber Agency, was as follows:

Destination.	1880.	1881.
James R., export and coastwise trade,.....	525	535
Richmond city,.....	124	322
Charlottesville and N. & S., via Va. Midland,.....	19	53
Waynesboro and N. & E., via. Shen. Valley RR.....	....	53
Staunton and N. & E. via Valley RR. of B. & O.....	49	43
Huntington and W. via Ashland & Ohio R.'.....	64	274
Local points on C. & O. Ry.,.....	253	377
Total car-loads,.....	1,034	1,693

The above statement shows that the general increase of the lumber traffic for July and August, 1881, was 659 car-loads, or 64 per cent greater than for same months of 1880, and indicates a large development of business at both the eastern and the western termini and at Richmond city and local points on the line of the railway.

The above statement does not include the transportation of ties or other lumber for the company's use, for which over a million feet in each month were transported.

The Coal and Coke Movements, from the mines, over the Chesapeake and Ohio Ry, for the month of July, 1881, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Mr. Charles M. Gibson, the Fuel Agent for the Company, were as follows:

	1880.	1881.
Fuel for use of Company	9,197	9,412
Shipped at Huntington on the Ohio river	7,792	8,452
Delivered on line of Elizabethtown, Lex'n & Big Sandy RR.	....	2,928
" " Chesapeake & Ohio R'y. west of Richmond	2,726	8,739
" at Williamson to Richmond & Alleghany Railroad.	....	259
" Staunton to Balt. & Ohio Railroad, Valley Division	....	43
" Waynesboro to Shenandoah Valley Railroad	....	300
" Charlottesville to Va. Midland R'y	2,586	4,282
" Gordonsville to do. do.	....	12
" Hanover Junction to R. F. & P. Railroad	946	....
" Richmond for consumption, including steam-tugs and dredges	4,732	5,354
Shipped at James River wharves	22,121	19,512
" Newports-News wharves	....	....
Totals	50,050	59,293

The total gain in 1881 over 1880, in July, was 9,243 tons, or a little over 18 per cent. The decrease in deliveries on line of road is what might be expected in this month; and the same might be said of shipments northward from Richmond.

The tons of each kind of coal fuel moved during the same July periods, and the increase or decrease in the movement were as follows:

Kind	1881	1880	1881. Increase,	1881. Decrease.
Cannel	3,011	4,614	.....	1,603
Gas	19,102	43,715	6,637	.....
Splint and Block	12,797			
New R. & other steam	18,453			
Coke	5,930	1,721	4,209	.....
Totals	59,293	50,050	10,846	1,603

The increase in the coke movement was about 245 per cent; a good measure of the increase and activity of the iron manufacturing business along the line of this railway.

The yearly fuel movement, in kinds, from Jan. 1st to July 31st, in 1880 and in 1881, and the increase or decrease in 1881 compared with 1880, were as follows:

Kind.	1881.	1880.	1881. Increase	1881. Decrease.
Cannel	10,487	25,030	.....	14,543
Gas	161,245	286,264	125,917	.....
Splint and Block	96,868			
New R. & other steam	154,068			
Coke	43,304	18,185	25,119	.....
Totals	465,972	329,479	151,036	14,543

From this statement it appears that the total increase in the yearly movement to July 31st, was 136,493 tons.

The Coal and Coke Movements from the Mines over the Chesapeake and Ohio R'y, for the month of August, 1881, and for the corresponding period of the previous year, in tons of 2,000 lbs., as reported for THE VIRGINIAS by Mr. Chas. M. Gibson, the Fuel Agent for the Company, were as follows:

	1880.	1881.
Fuel for use of Company	6,668	10,957
Shipped at Huntington on the Ohio river	8,389	2,532
Delivered on line of Elizabethtown, Lex'n & Big Sandy RR.	.....	3,698
" " Chesapeake & Ohio R'y west of Richmond	2,920	8,780
" at Williamson to Richmond & Alleghany Railroad	.....	253
" Staunton to Balt. & Ohio Railroad, Valley Divis.	.....	60
" Waynesboro to Shenandoah Valley RR	.....	725
" Charlottesville to Va. Midland R'y	2,287	4,841
" Gordonsville to "	43	27
" Hanover Junction to R. F. & P. Railroad	1,407	663
" Richmond for consumption, including steam-tugs and dredges	2,942	7,019
Shipped at James River wharves	24,120	25,849
" Newports-News wharves	.....	.....
Total	48,776	65,404

The gain in the movement in August, 1881, over that in August, 1880 was, 16,629 tons, or over 34 per cent; the gain over the preceding month of 1881, July, was 7,386 tons, or about 80 per cent, a consequence of the industrial activity now prevailing in the Virginias as well as elsewhere.

The tons of each kind of coal-fuel moved during the month of August, 1881, and during the corresponding period of 1880, and the increase or decrease of the movement, were as follows:

Kind.	1881.	1880.	1881. Increase.	1881. Decrease
Cannel	3,742	4,994	.....	1,252
Gas	22,617	41,487	14,259	.....
Splint and Block	10,827			
New R. & other steam	22,202	.....	.....	.....
Coke	5,916	2,295	3,621	.....
Totals	65,404	48,776	17,880	1,252

The gain in the coke movement was about 160 per cent over that for the same month in 1880; that of coals, excepting cannel, was over 34 per cent.

The yearly fuel movement, in kinds, from Jan. 1st to August 31st, in 1880 and in 1881, and the comparative increase or decrease for the respective years, were as follows:

Kind.	1881.	1880.	1881. Increase.	1881. Decrease
Cannel	14,228	30,024	.....	15,796
Gas	183,863	327,751	140,178	.....
Splint and block	107,705			
New R. & other steam	176,361			
Coke	49,219	20,480	28,739	.....
Totals	531,376	378,255	168,917	15,796

The increase in the entire fuel movement in 1881, up to Sept. 1st., over that of the same period in 1880, was 153,121 tons, or nearly 47 per cent; that in the movement of coke was over 140 per cent, and that in the movement of other coals than cannel was over 42 per cent. The decrease in movement in cannel coal was in consequence of the stoppage of mining operations at Peytona; there will doubtless soon again be an increase in consequence of the opening of new cannel mines.

Mr. C. M. Gibson, the Fuel Agent of the Chesapeake & Ohio Ry., by order of Sept. 1st, 1881 was put in charge of all purchases of and contracts for fuel for that railway, and of its distribution. All correspondence and reports relating to the purchase and distribution of fuel must be addressed to him.—We are pleased to note this advancement of a most faithful and meritorious officer, one to whom we are much indebted for carefully made reports of the fuel traffic of the C. & O. Ry.

Lead.—According to an able article on the Position of Lead, in the *Iron Age*, of New York, of Sept. 22, the price of common domestic lead per 100 pounds, at New York, has this year to this time, ranged from $4.25 to $5.25, while for the same period of 1880 it was from $4.50 to $6. Last year the price decreased during the time named, while this year it has increased. The U. S. will produce this year, it is estimated, 120,000 tons, (Leadville alone shipped 18,193 during the first half of the year.) So far the consumption appears to keep pace with the production, but the *Iron Age* fears that prices may be stimulated artificially and foreign lead be attracted here to the detriment of home producers. It thinks that lead at 5 cts. is cheap enough to stimulate consumption, but at 6 consumption would be curtailed, especially late in the year.

Powhatan Furnace, Henrico county, Va., on Richmond & Alleghany RR., 5 miles above Richmond, will probably go into blast about the first of next December, has been leased for a term of years and will be, hereafter, operated by Messrs. Thomas Dunlap, of Amherst county, Virginia, and C. W. Matthews, of Philadelphia. It will use James River, Va., ores and probably New River, W. Va., coke, though *The State* intimates that it may use anthracite. The furnace at this place, according to Swank's, 1880, Directory, is one stack 50x13½, built for coke, in 1860, and called Westham Furnace, and rebuilt for anthracite in 1872-3; open top; water-power; annual capacity 9,000 net tons. This furnace, the only anthracite one in Va., has been idle for a number of years. We are pleased to note its repair and the resumption of iron-making there where the conditions for success are good.

The Metal and Mineral Traffic of the Chesapeake & Ohio Ry. for July and August, 1880 and 1881.

By the courtesy of General Manager C. W. Smith, we have been furnished with data, compiled from the records of the company by Auditor of Revenue, Robert H. Fisher, from which we have prepared the following article on the metal and mineral traffic of the Chesapeake & Ohio Railway during July and August, 1880 and 1881. The returns of the coal and coke traffic of this railway for the same periods are given elsewhere. The quantities are in tons of 2,000 pounds:

	1881.			Compared with 1880.	
	July.	August.	Total.	Increase.	Decrease.
Pig Iron,.....	3,159	3,589	6,748	3,211	....
Iron Ore,.....	1,070	2,374	3,444	....	1,803
Manganese, ...	3	10	13	....	1,440
Limestone,.....	545	500	1,045	....	1,756
Marble,.....	263	246	509	210	....
Salt,.....	407	272	679	....	102
Lime,.....	224	239	463	285	....
Totals,.....	5,671	7,230	12,901	3,716	5,101

The increase in the movement of pig iron in July and August, 1881, was about 50 per cent more than during same months in 1880 The decrease in manganese traffic, as we have before stated, is in consequence of the opening of the Shen. Valley RR in the mean time, and the transfer of this traffic from Crimora mine to that road, as it passes near that mine; the decrease in limestone movement is because Quinnimont furnace, W. Va., has been out of blast for repairs, most of the limestone transported being for its use; and the same fact accounts for decrease in movement of iron ore, as that furnace derives its supply from Va. The increase in pig iron, marble and lime movements show the industrial activity of the current year.

The Pig Iron moved in July and August, 1881, was 6,748 tons; from Ferrol, 633 tons to Huntington, and 27 tons to Junction; from Longdale, 189 tons to Huntington, 12 to Richmond, 585 to Staunton; from Williamson, to Huntington 81 tons; from Jackson's River, 108 tons to Huntington, pig from Callie furnace; from Low Moor, 572 tons to Huntington, 617 to Richmond, 2,223 to Staunton, probably for shipment north or west by Valley RR.

For the same months of 1880, the movement was 3,536 tons:—From Longdale, to Huntington 1,679 tons; from Quinnimont. 1,617 tons to Huntington, 66 to Richmond, 39 to James River, 27 to Hanover Junction and 18 to Charlottesville.

The pig to Staunton was for shipment north and west by Valley RR. of B & O.; that from Williamson was from Richmond & Alleghany RR., probably from Salisbury furnace; that sent to Huntington was for western markets.

The Iron Ore movement for July and August, 1881, was 3,444 tons; From Ferrol, 26 tons to Quinnimont;—From Bell's Valley, 48 tons to Ferrol;—From Williamson, ore from Clifton Forge, Big Hill and other mines on Richmond & Alleghany RR., to Quinnimont 136 tons, to Huntington 389, to Ferrol 844;—From Jackson River, 24 tons to Low Moor, and 100 to Huntington;—From Low Moor, 299 tons to Huntington;—From Covington, 498 tons to Quinnimont, 33 to Huntington, and 51 to Low Moor;—From Backbone, 118 to Low Moor, and 879 to Huntington.

In July and August, 1880, the movement of iron ore was 5,246 tons;—From Tolersville to James River 126 tons;—From Ferrol to Quinnimont 2,834 tons;—From Clifton Forge 606 tons to Quinnimont, and 71 to Ferrol;—From Callaghan (Backbone) 600 to Quinnimont, 597 to Low Moor, and 11 to Ferrol;—From Waynesboro 402 to James River.

The Copper Ore movement in July and August, 1880, was 188 tons; 40 from Huntington, W. V.. in transit, and 148 from Tolersville, Va., to James River; none was moved in these months in 1881. Negotiations are pending that may lead to working the Tolersville mines again.

The Manganese Ore moved in July and August, 1881, was only 13 tons; 3 from Huntington to Richmond, and 10 from Waynesboro to James River.—For same months of 1880 1,453 tons were moved, 732 from Huntington, and 694 from Waynesboro to James River, and 27 from Waynesboro to Huntington.—The course of part of this trade has been changed by the opening of the Shenandoah Val. RR.

The Limestone movement for these months in 1881 was 1,045 tons from Fort Spring to Quinnimont; and in 1880 it was 2,801 tons also from Fort Spring to Quinnimont.

Marble was moved in 1881 during these months, from Craigsville, 405 tons to Waynesboro, for market north by Shen. Val. RR, 36 tons to Huntington, for western, and 68 to James River for northern markets,—total 509 tons.—In same time in 1880, the movement was 299 tons, all from Craigsville, 244 to James River and 55 to Staunton.

The Salt movement of 678 tons in July and August, 1881, was 29 tons from James River, and 316 from Richmond, foreign salt to local stations; and 94 tons from Malden, W. Va. salt, to local stations.—For same time in 1880, 781 tons were moved, 199 from Richmond and 233 from James River, imported salt, to local stations, and 349 from Malden, W. Va. salt, to Huntington.

Of Lime, 463 tons were moved in July and August, 1881; from Waynesboro 179 to Richmond, 24 to Staunton and 20 to way stations; from Fishersville, Va., 156, and from Fort Spring, W. Va., 84 to way stations.—For same time in 1880, the movement was 177 tons; 10 from Trice to Low Moor and 20 to James River; from Fishersville 43 to local stations; from Fort Spring 85 to way stations.

The Richmond & Alleghany RR. was completed from Richmond to Williamson so that trains passed over the road on a regular time-table, for a copy of which we are indebted to Samuel L. Southard, Supt. of Alleghany division—on the 21st of Sept., 1881.

At Williamson, the present western terminus of this road, it joins the Chesapeake & Ohio Ry., 193 miles from Richmond and 227 miles from Huntington by the C. & O.

As having a present interest we give below the present stations, etc., of the Alleghany division of the R. & A. RR., a portion of which were given in the number for May last:

Richmond & Alleghany RR. Stations. (Alleghany Division.)	County in Va.	Miles from Williamson.	Feet above Tide.†
Williamson*	Alleghany.	....	1,053
Iron Gate	"	2	1,026
Lick Run	Botetourt.	4¼	1,014
Wilton	"	6¾	.....
Baldwin	"	9¼	.....
Hadon	"	11	.....
Price's Bluff	"	12¼	.....
Gala Water	"	13¾	.....
Eagle Rock*	"	17¾	932
Salisbury	"	22	888
Saltpetre Cave	"	25	.....
Glen Allen	"	27½	.....
Jackson	"	30¾	841
Buchanan	"	35	812
Indian Rock	"	41½	786
Natural Bridge	Rockbridge.	49	742
Glenwood	"	52½	.....
Balcony Falls*	"	55¾	706
Rope Ferry	Amherst.	60	661
Jordan	Bedford	62¾	644
Big Island*	"	64¾	606
Coleman	"	69	588
Pedlar	"	71¾	572
Holcomb Rock*	"	71¾	571
Bethel	"	75	558
Rolling Mill	Campbell.	79¾	540
Va. Midland Junction*	"	82¾	.....
Lynchburg*	"	83½	513

*Telegraph stations. †These altitudes (except Williamson) are those of the James R. & Kanawha Canal; those of the railway will probably be a few feet higher.

Now, a passenger train, No. 2, leaves Williamson daily, except Sunday, at 8 A. M., passing Buchanan at 9:58, and the Natural Bridge at 10:39, and arriving at Lynchburg at 1:05 P. M. Returning, as No. 1, this train leaves Lynchburg at 2:45 P. M., passing the Natural Bridge at 5:12 and Buchanan at 5:35, and arriving at Williamson at 7:48. These trains connect with both east and west bound trains on the C. & O. at Williamson, and on the Va. Midland and Norfolk and Western at Lynchburg.

The Lexington Branch of the Richmond & Alleghany RR. leaves the main line at Balcony Falls station, near the mouth of North river. On the 21st trains ran on that branch 4½ miles, to Miller's landing, opposite the mouth of Buffalo creek.

In the General Rules for Trainmen, we note some that we do not remember to have seen in those of other roads, or if among their rules they are not observed; such as making all trainmen alike responsible for the running of a train in violation of the rules; giving conductors and engineers the right to command the services of any employee of the company in case of an accident or detention; requiring the testing of air-breaks by starting and stopping the train at termini and where changes of cars have been made; requiring the testing of switches that have been used where no one has charge of them; making trains of a like class come to a full stop in passing; requiring conductors to be at trains 30 minutes before starting time and to see that the cars are in proper condition, and do all in their power to promote the safety, comfort and pleasure of passengers; requiring brakemen to be at the brakes constantly when the train is in motion, one always to be with the rear car (and at the rear brake, should be added.)

Tobacco Production in Virginia in 1879.

Census Bulletin No. 263, dated July 13, 1881, and lately issued, is a preliminary report on the "culture and curing of tobacco," by J. B. Killebrew, special agent, accompanied by a return of the "tobacco crop of the U. S., by counties," the crop of 1879, which is the one "returned" for the census of 1880.—From this report and from the census report of 1870 we gather the following facts on the subject in reference to Virginia:

In 1880 Virginia ranked among the States 2d in the production, acreage and total value of the tobacco crop reported, Kentucky ranking 1st in these particulars and Pennsylvania 3rd in production and value of crop. In value per acre Virginia stood 14th., outranked by most of the producing states; in value per 100 lbs. her place was 12th., and in cost per 100 lbs. it was 10th; in difference of cost and value she ranked 13th.

In Virginia the acreage cultivated in 1879 was 140,791; the production was 79,988,868; the value of the crop in the planter's hands was $5,406,744; its value per 100 lbs. was $6.75; its value per acre was $38.40; the cost of producing 100 lbs. was $5.33; and the difference between the cost of 100 lbs. and its value was $1.42.—The last of these items represents the planter's profit, and since in that item Virginia ranked 13th, it would seem that this business did not pay very well.

The report says—"The profit in growing tobacco in Virginia came from the production of yellow wrappers, bright "smokers," and sun-, air-, and flue-cured fillers"—"Profits in the culture of tobacco have been in direct proportion, first to its suitableness to domestic consumption; and, secondly, to the amount of fertilization practiced by the growers in its cultivation. And this is true in every case, except in the yellow tobacco districts of N. C. and Va., where poverty in the soil is a condition of success in the production of quality."

This report divides U. S. tobacco into *classes*, *types* and *grades*. The classes are: I,—Domestic Cigar and Smokers; II,—Chewing; III,—Export.—"Common Virginia lugs" appear as a type of the first class. Virginia "sun-cured, "air-cured," "flue-cured" and fire-cured" fine-cut and plug fillers, and "yellow and mahogany" plug wrappers as types of the second class. Virginia "bird's-eye cutting leaf, mottled," "brown roll wrapper, clear red-brown leaf"; "spinning leaf, heavy, fat and dark"; "spinning fillers, or shag, heavy cutting leaf"; "plug wrapper, dark, heavy bodied leaf;" "navy, mottled, sweet leaf"; "Irish filler, fat, dark, heavy body lugs or common leaf"; "Scotch elder, thirsty, red brown leaf"; and "strips, snuff lugs," are among "English shipper" types of the third class; in which class she also furnishes "Continental shippers to closed markets," those in which tobacco trade is a government monopoly, as French, Italian, Austrian, and Spanish "Regie"; and Continental shippers to open markets," as Switzerland, Holland, Belgium, Norway and Sweden, each requiring named grades of certain types. African, Mexican, South American, and West Indian grades of this class are also furnished by Virginia.

The amount of *nicotine* (the active, poisonous principle that we, as a tobacco hater, suppose is the essential element of its goodness) contained in a large number of types of tobacco, was determined. Heavily manured Virginia heads the list with 5.81 per cent; Va. French Regie is 4th, with 4.81 per cent; Va. heavy Eng. shipping, 5th with 4.72 per cent; German, low-grade, Va., 9th, with 4.30 per cent; and Va. sun-cured, for plug, 20th, with 3.27 per cent.—The northern and northwestern tobaccos have the least nicotine.

The "coefficient of absorption," or quantity of water each type will absorb without dripping, was also ascertained. German "low-grade" heads the list of 23 samples with an absorption of 2.88 per cent, "Va. German shipper" closes it with one of 1.12 per cent. "Regie Va. shipper" ranked 10th, absorbing 2.14 per cent; "Va. sun-cured for plug," 13th, with 2 02;—"Va. Eng. shipper," 14th, with 1.95; "Va. heavily manured, 16th with 1.92; and "Va. French Regie A," 22nd, with an absorption of 1.41 per cent.

Below we have arranged the acreage and production of the census of 1880, and the production of the census of 1870, by counties grouped, as in "Hotchkiss' Summary of Va.," by Grand Divisions, thus showing, better than in any other way, the changes that during the decade, 1870-'80, have taken place in the tobacco culture areas of the state, and also furnishing the data for a comparison of production in 1870 and in 1880.

The report makes it that 140,791 acres, or 220 square miles, of Virginia s area were cultivated in tobacco in 1879, producing 79,988,868 pounds of tobacco, valued at $5,406,744 in the planters' hands. The average production per acre was 568 pounds, of an average value of $38.40 per acre, of which sum the average cost of the production per acre was $33.33, leaving $8.07 profit. The items of cost are not given in the report, so we do not know what it includes.

1. **Tidewater Grand Division** of Virginia, containing some 10,850 square miles, or 6,944,000 acres, furnished the following returns of Tobacco Production in 1880 and 1870:

Counties. Grouped topographically,	1880. Acres.	1880. Pounds.	1870. Pounds.
King George,	20	9,775	2,662
Westmoreland,	14	13,450	4,245
Richmond,	14	7,322	1,736
Northumberland,	11	6,745	135
Lancaster,	..	..	...
Essex,	13	5,015	140
Middlesex,	4	1,512	30
King-and-Queen,	30	14,711	70
Mathews,	..	...	..
Gloucester,	25	13,829	949
Caroline,	1,264	991,437	417,848
King William,	97	63,065	28,850
Hanover,	1,489	1,064,735	439,434
New-Kent,	14	11,860	8,600
James City,	..	...	135
York,	5	1,061	410
Warwick,	..	...	..
Elizabeth City,	..	...	..
Henrico,	106	101.155	11,175
Charles City,	..	...	2,200
Prince George,	27	20,500	1,800
Surry,	..	...	...
Sussex	5	4,715	16,100
Southampton,	5	775	25
Isle-of-Wight,	5	420	...
Nansemond,	1	215	...
Norfolk,	..	...	...
Princess-Anne,	..	...	400
Accomac,	..	...	...
Northampton,	12	1,740	...
Totals,	3,161	2,334,037	936,944

2. **Midland Grand Division** of Virginia, embracing some 12,470 square miles, 7,980,800 acres, furnished the following Tobacco Production returns in 1880 and 1870.

Counties. Grouped topographically.	1880. Acres.	1880. Pounds	1870. Pounds
Alexandria,	...	...	65
Fairfax,	4	5,370	50
Prince-William,	5	1,292	1,616
Stafford	7	4,280	1,070
Spotsylvania,	554	396,668	132,502
Louisa,	2,978	1,921,488	930,226
Fluvanna,	1,391	917,561	894,023
Goochland,	1,052	656,624	405,215
Buckingham,	3,973	2,136,529	809,937
Cumberland,	2,979	1,814,674	956,855
Powhatan,	1,479	914,132	541,430
Chesterfield,	804	523,696	194,510
Appomattox,	3,198	1,965,937	656,944
Prince Edward,	4,357	2,462,326	960,700
Amelia,	3,524	1,726,317	1,037,721
Dinwiddie,	2,752	1,540,395	844,504
Nottoway,	2,911	1,582,670	653,296
Lunenburg,	3,409	1,976,265	963,673
Brunswick,	2,734	1,538,161	1,121,480
Greensville,	11	5,075	33,200
Campbell,	6,446	3,927,333	1,761,901
Charlotte,	5,922	3,226,448	1,964,736
Pittsylvania,	22,680	12,271,533	4,282,511
Halifax,	15,042	7,653,842	3,838,284
Mecklenburg,	6,439	3,436,408	2,166,628
Totals,	94,651	52,605,024	25,153,077

3. Piedmont Grand Division of Virginia, embracing about 6,680 square miles, or 4,275,200 acres, furnished the following returns of Tobacco Production in 1880 and 1870.

Counties. (From Potomac southwest.)	1880. Acres.	1880. Pounds.	1870. Pounds.
Loudoun,	6	2,454	. .
Fauquier,	17	6,077	2,205
Culpeper,	6	2,470	2,836
Rappahannock	12	3,330	23,918
Madison,	132	101,697	60,650
Greene,	529	382,492	262.030
Orange,	372	260,715	46,460
Albemarle,	3,216	2,466,972	1,781,619
Nelson,	3,497	2,660,295	1,199,182
Amherst	4,610	3,111,801	1,285,471
Bedford	9,174	5,315,560	1,956,157
Franklin	6,862	3,529,833	1,696,549
Henry	6,336	2,955,036	1,129,617
Patrick	1,645	714,073	323,886
Totals,	36,414	21,512,805	9,770,580

4 Blue Ridge Grand Division of Virginia, having an area of about 1,230 square miles, or 787,200 acres, gave the following returns of Tobacco Production in 1880 and 1870.

Counties (Blue Ridge Plateau.)	1880. Acres.	1880. Pounds.	1870. Pounds.
Floyd,	827	342,250	157,467
Carroll	83	29,375	9,557
Grayson,	32	10,485	6,401
Totals,	942	382,110	173,425

5. The Valley Grand Division of Virginia, with an area of about 7,550 square miles, or 4,832,000 acres, furnished the following returns of Tobacco Production in 1880 and 1870.

Counties.	1880. Acres.	1880. Pounds.	1870. Pounds.
Frederick,	1	705	825
Clarke,	10	9,555	....
Warren,	2	2,303	1,117
Shenandoah,	5	3,106	....
Page,	8	5,237	3,435
Rockingham,	14	9,564	332
Augusta,	4	1,827	2,000
Rockbridge,	517	360,065	186,469
Botetourt,	1,187	742,953	196,459
Roanoke,	1,022	588,410	280,550
Montgomery,	1,333	654,496	204,747
Pulaski,	211	122,776	18,580
Wythe,	16	7,383	478
Smyth,	40	17,850	1,575
Washington,	679	353,457	27,864
Totals,	5,049	2,876,687	924,331

6. Apalachia Grand Division of Virginia, about 4,520 square miles, or 2,892,800 acres, furnished the following returns of Tobacco Production in 1880 and 1870.

Counties.	1880. Acres.	1880. Pounds.	1870. Pounds.
Highland,	1	567	.....
Bath,	8	5,815	.....
Alleghany,	11	6,862	25,747
Craig,	58	38,540	15,750
Giles,	199	122,056	30,653
Bland,	10	4,164	2,440
Tazewell,	48	18,357	5,026
Russell,	34	11,405	17,282
Scott,	135	49,659	16,557
Lee,	54	15,286	.....
Totals,	558	272,711	113,455

7. Trans-Apalachia Grand Division of Virginia, about 1,200 square miles, or 768,000 acres, furnished the following returns of Tobacco Production in 1880 and 1870.

Counties.	1880. Acres.	1880. Pounds.	1870 Pounds.
Buchanan	10	2,186	6,424
Dickenson,	..	.....	.....
Wise,	6	3,308	8,128
Totals,	16	5,494	14,552

RECAPITULATION.

Grand Division.	1880. Acres.	1880. Pounds.	1870 Pounds.
1. Tidewater,	3,161	2,334,037	936,944
2. Midland,	94,651	52,605,024	25,153,077
3. Piedmont,	36,414	21,512,805	9,770,580
4. Blue Ridge,	942	382,110	173,425
5. The Valley,	5,049	2,876,687	924,331
6. Apalachia,	558	272,711	113,455
7. Trans-Apalachia,	16	5,494	14,552
Totals,	140,791	79,988,868	37,086,364

Mineral Resources of the James River Valley.

Under appointment of the President and Directors of the Richmond & Alleghany RR. Co., an extended survey of the mineral deposits along the James River valley was made during the past summer by Prof. J. L. Campbell, of Washington & Lee University. A full report, showing the kind and extent of the minerals found in this important region, is in course of preparation, and will soon be ready for the press.

The iron ores, being the most important, will of course occupy the most prominent place. The Buckingham field, which covers a large portion of that county, and runs to some extent into Cumberland, will have its claims duly presented. Its limonites, magnetites and specular ores will all be shown to be valuable. The James River field of ores, of the same classes, has already been brought into notice in a somewhat fragmentary way, but in this forthcoming report we may expect a more systematic representation of the whole field.

The discussions of the limonites and the specular ores of the Blue Ridge, the limonites and red-shale ores of Purgatory and North mountains, and of the Great Rich-Patch field, as given in the report prepared for the J. R. & K. Co., and published in THE VIRGINIAS nearly two years ago, will be revised and greatly extended, in view of more recent explorations and developments.

The facilities for working these ores will be brought fully into view,—such as furnace sites, the easy and abundant supply of fuel and flux, and the readiness with which the great variety of ores found along this line of railway can be brought together to be worked in mixture.

The copper mines, present and prospective, the gold belt, and the Richmond coal fields have been examined, and will claim a place in this report. The granite and slate quarries, too, will come in for a good share of space; while the limestones of the Great Valley will be made to occupy the space their high merits deserve.

The minor minerals, such as mica, steatite, kaolin, fire-clay, &c., will not be overlooked.

Preparatory to a full appreciation of the full value of all these mineral resources, the topographical and geographical peculiarities of the region traversed by the R. & A. RR. will be presented to the reader's mind.

Prof. Campbell has worked for several months, in the field and in his office, in the preparation of this report, and we are sure, in advance of its appearance, that it will prove a timely and most valuable addition to the economic, as well as to the scientific geology of Virginia.

The metal and mineral movement by the Norfolk & Western RR. from Jan. 1st to Sept. 1st, 1881, by substances, in 2,000 lbs tons, was as follows:

	Va.	So. States.	Totals.
Iron ore,	5,541	.....	5,541
Pig iron,	9,078	384	9,462
Lead ore,	10	5	15
Pig Lead,	36	11	47
Zinc ore,	1,092	152	1,244
Zinc spelter,	216	115	331
Barytes,	2,855	11	2,866
Plaster,	4,001	....	4,001
Limestone,	3,105	....	3,105
Marble,	16	2,128	2,144
Manganese,	236	1,283	1,519
Salt,	4,083	....	4,083
Coal,	5,093	216	5,309
Copper ingots,	.....	151	151
Totals	31,937	3,844	35,781.

"Our Vital Interests" is the subject of an excellent editorial in the *State Tribune*, a broad-paged and well filled weekly paper, the publication of which has recently begun at Charleston, W. Va. In the article named the citizens of Charleston are urged to engage in manufacturing, and it concludes with these words:

"It is the experience of those cities which now command the trade of many States, that the impediment to manufacturing success lays in getting the first furnace and the first rolling mill. These located and in operation, around them will gather others, similar and dependent, till the hum of productive labor shall resound all along our shores and reverberate its rich tones from our hillsides. If we do not put our hands to the work, but wait for outside aid alone, we cannot expect its accomplishment either at an early or later date.

Cannot something be done to induce capital, seeking better returns than in three-and-a-half per cent bonds, to invest in this direction? Perhaps, if effort was made at home to complete the iron woks begun some years ago below Elk, it would prove to be an easier task than anticipated. Traces of the hard times are at last vanishing from our city, and we are informed that large sums, the profits of recent land sales, are accumulating in our banks. Could not this idle capital be drawn out to put in operation the furnace over the river. We do not know who are the owners of this valuable and idle property, nor in what shape the title rests, but no doubt it would pay those financially interested to put it into a liberal offer for home capital and outside skill to take hold of. The era of railway building now upon us, promises large profits to iron manufacturers. The early producers will be likely to reap the largest returns."

The Lumber Trade of Norfolk, Va., is estimated by *The Virginian*, as now worth over $2,000,000 a year. In the year ending with August, 1879, that city received 49,363,432 feet of lumber, 46,510,667 shingles, 5,017,913 staves, 47,147 railroad ties, 26,620 last blocks, and 2,953 cords of juniper logs, valued at over $1,500,000.

The Potomac Fisheries, as we learn from a most reliable source, are speedily recovering from their exhaustion, by virtue of the extensive measures for artificial reproduction so wisely and persistently prosecuted by Prof. Spencer F. Baird, the U. S. Commissioner of Fish and Fisheries. The hatching operations of the season of 1881 were on a scale unprecedented in fish culture. The result of the season's work was the placing of 26,000,000 young shad in the Potomac and the furnishing of about 14,000,000 for the fertilization of other streams. The magnitude of this work will be better appreciated when it is realized that for every mature shad taken from the Potomac for consumption, 50 young shad were returned to the water; and, besides, these young shad were hatched from eggs not one of which would have been hatched under natural conditions.

The shad and herring fisheries of Virginia now yield a product worth about $500,000 a year; those who have made the subject of our river fisheries a study, and who are competent to speak authoratively on the question of fish production, estimate that this value could be easily increased to $1,500,000 if the free circulation of migratory fish, especially shad, up our rivers, were secured to the breeding and feeding grounds these rivers can furnish when the right-of-way by unobstructed channels is secured to these valuable food fishes. Our area of breeding and feeding ground can be readily enlarged two or three times, and no time should be lost in making this enlargement.—Virginia must exercise more liberality in the treatment of her Fish Commission. We cannot afford to neglect the development of such a great source of wealth or to have withheld from us so much good and enjoyable food.

The Virginia Military Institute opens its session of 1881-2 under favorable auspices, its new class being the largest for several years. The cadets, about 120 rifles, will be the body-guard of the Governor of Virginia at Yorktown. Ex-cadets, if unitormed, will be received into the corps for the Yorktown Centennial.—*The State.*

Lynchburg Iron, Steel and Mining Co.,

WORKS AT LYNCHBURG, VIRGINIA.

Manufacturers of Bar and Loop Iron, Railroad Spikes, Fish Plates, and Bolts. Also, Machine Work of all descriptions. SPECIALTIES:-Blast Furnace and Rolling Mill Machinery, Hydraulic Cotton Screws, Mining Machinery and Bridge Work of all kinds. Office, 319 Walnut Street, Philadelphia.

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RATES GREATLY REDUCED AGAIN TO SUIT THE TIMES.

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This splendid new hotel is situated in the heart of the city, and adjoining the beautiful Capitol Park, with its Statuary, Monuments, Fountains, Groves, and Flower-beds; is newly and elegantly furnished throughout. It is convenient to all the Depots and Fine Coaches run to and from all the Stations and Steamboat Landings.
Special suits of rooms will always be kept in readiness for wedding and other large parties.
Notice.—The delightful climate of Richmond is unsurpassed, thereby claiming the attention of tourists and invalids.

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The "Old Reliable." The People's Favorite. Complete in all its Appointments.

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Is always open to HANDLE this ore by PURCHASE or CONSIGNMENT. Guarantees GOOD VALUE and prompt returns. Correspondence invited on this and all other

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I offer for lease, on liberal terms, the deposits of **Manganese and Mineral Paints**, consisting of Ochre, Umber, Terra di Sienna, Carbonate of Iron, &c., upon my estate near Fishersville Depot, on Chesapeake & Ohio Railway and line of Shenandoah Valley Railroad, in Augusta county, Virginia. Examination invited. Correspondence may be had with the undersigned at Fishersville, or his counsel, Thomas D. Ranson, at Staunton, Va. SAMUEL H. STEELE.

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THE PAINT CREEK MINING Properties of Kanawha County, West Virginia.

PAINT CREEK MINING CO., (On west side of Paint Creek.) **10,000 acres.**

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All under one management with same directors and same stockholders holding same ratio of interest in each company.

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These companies have been organized for the de velopment of valuable coal loads owned by them. They are now constructing a first-class railway through the properties, having its terminus in the pool above Lock and Dam No 3, part of the mprovements now being constructed by the U. S. Governmen on the Kanawha River. This railway will be completed and equipped for transportation of coal in September, 1881. It crosses the C. & O. Ry. and connects with it, so that shippers will have every facility for both river and railway trade.

The companies are prepared to make leases to reliable parties and to ship the coal of their lessees to river and rail uponmost favorable terms.

Their Cannel, Splint, Bituminous and Coking Coals are unexcelled in quality, quantity and size of workable seams:—the principal splint coal seam averaging ten feet.

Application for leases may be made to the President direct or through any of the Directors.

More particular information given upon request, by mail or otherwise, to L. L. Conrad, President, 15 Lexington street Baltimore, or Isaac N. Smith, Charleston, Kanawha county, W. Va., Solicitor of the Companies.

JAMES RIVER SPECULAR ORE PROPERTY FOR SALE.

We offer the fee simple in the MINERAL RIGHTS on 750 acres of land, immediately on the James River Canal and the Richmond & Alleghany RR. This property is situated a short distance below Riverville, in the heart of the magnetic and specular ore belt of the James River Valley. It is one of the most valuable iron ore properties now on the market—the deposits being very large, and the ore of the purest quality Price $16,000.

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THE OLD BLACKFORD FORGE PROPERTY,

Including Water-power and Over 600 Acres of Land,

On Hawksbill Creek, Below Luray, Page County, Virginia,

And on line of Shenandoah Valley Railroad, is hereby offered for sale. For terms, etc., address

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625 ACRES OF NEW RIVER COKING COAL LAND can be leased for a term of fifteen or more years, upon a royalty of seven cents per ton (of 2240 lbs) with option of purchase, to parties who are responsible, and willing to begin work at an early day.

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Sept. and Oct.

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I offer for sale the Residence of Mrs. Virginia B. Donaghe, fronting on three of the principal streets—Main, Lewis and Frederick—in immediate proximity to business, churches, schools, &c. The improvements are first-class, and the property one of the best, if not the very best in the city, either as a home or a speculative investment. It will be subdivided if not sold as a whole. Examination invited.

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The undersigned, as President of a Land Company, has for sale or lease, on favorable terms, some of the best coal and timber lands in the New River District, on the line of the Chesapeake and Ohio Railway. The coals on these lands are the **Coking Coals**, the coke from which is now so much in demand for blast-furnace and other metallurgical uses. For further information and terms, apply to

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I offer for sale an undivided one-fourth interest in 64,781 acres of timber lands, in Wyoming Co., Va., and situated on a branch of the Guyandotte river.

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For particulars, address, FRANCIS H. SMITH,
Superintendent.

Iron-making at Ferrol Furnace, Va.—From the Valley Virginian of Oct. 6, 1881, we extract this editorial item:

The following statement will show the cost of making a ton of iron at Ferrol Furnace in this county. This statement is important in view of the fact that the impression has gone abroad to the injury of the iron properties of Virginia that a ton of iron cannot be made under $20. Mr. Hemphill is an experienced iron man, of thirty years practical connection with iron properties. He is known all through the North as a gentleman of sterling worth, and his name to a paper will pass it to the confidence of those who know him. He, in connection with another eastern gentleman, has, after testing the ores of Ferrol, and their output, leased the property for one year, with the privilege of five, unless the company should decide otherwise, at $5,000 per month or $60,000 per annum, payable monthly. Mr. Hemphill, after a careful test, gives it as his judgment that Ferrol is one of the most valuable iron properties in the United States, and if it were in Pennsylvania, would command $2,000,000.

The following is an official itemized statement of the cost of making a ton of iron at this Furnace. For the month of September 337 tons were turned out, and the month's operations give a net profit to the company of over $4,000, independent of shipping of ores, with many disadvantages and draw-backs in the re-organization of the working force and in the operations.

PA. AND VA. IRON AND COAL CO.,
FERROL, VA, Oct. 1st, 1881.

R. N. POOL, Esq., President:

Dear Sir:—I send you the following statement of the cost of one ton Pig Metal at Grace Furnace during last September:

2¼ tons Ferrol ore at $1.08 per ton	$2.52
2,500 lb. coke at $3.70 per ton	4.62½
Limestone	.74½
Furnace labor including foundry	2.45
Superintendence	.73
General expense account	.15
Total cost	$11.42
Deduct net earnings of store	1.05
Cost per ton	$10.37

To this cost of $10.37 should be added $1.00 per ton for sinking fund to meet furnace repairs.

During the month of September the furnace was stopped four times for the following causes: On the 1st, 9 hours to repair feed pipe to boilers; on the 7th, 16 hours to repair hot blast; on the 20th, 36 hours to scale boilers and further repairs to hot blast; on the 28th, 6 hours on account of strike caused by Pluemer & Co's attachment. These stoppages caused a decrease in production of 45 tons of metal.

Yours truly,
JAMES HEMPHILL, Gen'l Manager.

The Virginia, Tennessee & Georgia Air-Line is the name of a railway combination made, by contract of the 28th instant, which unites permanently the Shenandoah Valley and the Norfolk-and-Western railways of Virginia, some 700 miles of road, with the East Tennessee-Virginia-and-Georgia system of roads, some 1,400 miles in extent, making 2,138 miles of road in the combination.—Pres. E. W. Cole, of the E. Tenn., Va. & Geo., and Pres. F. J. Kimball, of the S. V., are the executive committee for the whole line, and Henry Fink is the general manager.

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JED. HOTCHKISS,
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Consulting Engineer;
Examines and Reports on Mineral Lands and their Titles; makes Geological and Topographical Surveys, Maps, &c. May be consulted in reference to purchase of lands in Va. and W. Va

W. H. DEWEES,
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Offers his services in the making of geological examinations, surveys or reports; in superintending the experimental development of mineral land and negotiating purchases. Agent for Pennsylvania Diamond Drill Co.

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The Mineral Lands of Southwest Virginia, in the Blue Ridge, Valley, and Apalachian Districts a SPECIALTY. Correspondence olicited.

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Titles to Mineral and other Lands, in Virginia and West Virginia, carefully examined.

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Conference with parties proposing to purchase orsell real estate of any kind in Virginia respectfully solicited.
☞ Best references furnished when desired.

Wm A. Hudson Wm. Patrick.
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Staunton, Virginia.
Practice in the Courts of Augusta and adjoining counties. Land titles a specialty. Refer by permission to N. P. Catlett, Cashier Augusta National Bank; Thos. A. Bledsoe, Cashier, National Valley Bank.

The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 10. } Staunton, Virginia, October, 1881. { Price 25 Cents.

The Virginias,

PUBLISHD MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor.

At 346 E. Main St., Staunton, Va.

Terms, including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising, per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

Entered at Staunton, Va., Post-office, as second-class matter.

Rogers' Va. Geological Reports.—Persons having copies of these reports for 1836, 1837, 1838, 1839 or 1840, that they will sell at a fair price, can find a purchaser by addressing Jed. Hotchkiss, Staunton, Va.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors,), complete, with index and title page, wil be sent, prepaid, to any address in the U. S., *on receipt of Three Dollars.*

The Harrisburg meeting of the American Institute of Mining Engineers, Oct. 25-28, was from first to last, a most enjoyable occasion. The visits to the Central Iron Works, the Chesapeake Nail Works, the Paxton furnaces and rolling mills, the Harrisburg Car Manufacturing Co.'s Works, and the Pennsylvania Steel Works, in and near Harrisburg, were exceedingly interesting,—in them we saw the secret of the great prosperity of Pennsylvania's capital city, an inland town, of which we shall say more hereafter.

The trip to the iron ore deposits, to the Carlisle Iron Works and to Pine Grove Furnace, on the eastern side of the Cumberland valley, (the extension of the ore beds of our Western Blue Ridge into Pa.,) was delightful and highly instructive for the opportunity it gave us for comparing these Pa. deposits with our Va. ores; the look-in at the Carlisle Indian School was suggestive of a better outcome for the red man.

The run through the charming Lebanon valley—part of Pennsylvania's portion of the Great Valley, and the inspection of grand Colebrookdale furnaces and the famous Cornwall iron ore beds, (the most productive in the U. S., in 1880), furnished sights that could be seen nowhere else in the United States.

The citizens' reception, the Pennsylvania Steel Company's lunch, the lunch of Mr. Fuller at Pine Grove Furnace, the perpetual lunch (or something else) on the cars that carried us, the lunch by Mr. Coleman in the Opera House of the fair town of Lebanon, and, to crown all, the complimentary dinner at the pleasant Lochiel House, tendered by the Pennsylvania Steel Company, were all of the very best, and all enjoyed them to the full.

We can never forget the many courtesies we received from citizens of Harrisburg and from our fellow members of the Institute. All the Virginia members in attendance—and we regret that the number was small—were the recipients of extra attention, the result, doubtless, of remembrances of the Virginia meeting of the Institute.—Personally we owe especial thanks to Messrs. A. S. McCreath and L. H. Chauveret.

Of the papers read and of many things seen and heard we shall write hereafter.

Brick clay.—The owners of the immense beds of brick-clap in and near Manchester, Va., refuse to sell the land containing them, believing it will largely increase in value with the growth of that city and Richmond.—*Richmond Dispatch*, Nov. 12, 1881.

The Foundry, Machine Shops, Water-Power, etc., that Commissioners Bouldin and Withers offer for sale in our advertising columns, page 159, in the thriving and wealthy city of Danville, are well worth the attention of machinists, foundry and mill men, manufacturers and capitalists.—Danville is at the junction of great lines of railway and has ample facilities for reaching raw materials and markets; it is on the very borders of the great cotton-belt; the iron ore regions of Va. and N. C. are not far from it. Few places can offer better inducements for manufacturing enterprises.—It is not only a most excellent place for cotton manufacturing, but is also as well situated as any place can well be for the manufacture of machinery for the Cotton States, and for the manufacture of railway rolling stock. Its new railway, northward and westward bound, now in process of construction, will add largely to even the present good advantages this city offers to enterprising manufacturers.

The Davis Creek Coal and Iron lands, Kanawha county, W. Va., are quite sure to attract the attention of investors, coal and iron ore miners and iron makers after the publicity that has been given to the excellent reports on their mineral resources by Dr. Shaler and Prof. Sharples by their publication in this and the preceding number of THE VIRGINIAS, and by the publication of the report of the latter as a paper in the Transactions of the American Institute of Mining Engineers.

The Terragenta Iron and Coal Co. (See page 147.) has purchased the lower portion of the basin of this creek and the Black-Band Iron & Coal Co. (See page 151.) the upper portion. We understand that Mr. James F. Lewis of Charleston, W. Va., controls and has for sale much of the land, some 2,000 acres, lying between the lands of the two companies named. We hope (and Mr. L. knows not of our saying so) sale may soon be made of this intermediate tract, one having all the resources and advantages of the ones lying on each side of it, and that the owners of the three may unite in a scheme of improvement that will fully develop the resources of this highly promising coal and iron basin and demonstrate that good iron can be profitably made there on a large scale.

Personals.—Mr. Geo. W. Bramwell, C. E, who had charge of opening the coal mines, erecting an incline, coke ovens, etc., at Stone Cliff, C. & O. Ry, W. Va., for the Fayette Coal and Coke Co., has resigned his superintendency there and become the General Superintendent of the New York Steam Cable Towing Co., with his office at 145 Erie St., Buffalo, N. Y.—He writes us that the system of Cable-Towing which he represents has heretofore met with considerable opposition from the canal men, but now they are beginning to see that horses must give away to steam. Happily for us in Virginia we have lost all interest in canal questions. We regret the loss of so excellent an engineer from our states, but congratulate the Cable-Towing Co., on having secured his services.

Mr. N. M. Jenkin, formerly in charge of mining operations for the New York & Ohio I. & C. Co., Ironton, Ohio, has recently become superintendent of the Fayette Coal & Coke Co., Stone Cliff, W. Va., in place of G. W. Bramwell, who resigned.—We are pleased to note the return of such an efficient superintendent as Mr. Jenkin to mining and coking operations on New River; he once had charge of similar work at Quinnimont in the same region.

Investments in Virginia Lands are said to be the best that can be made, and in this connection it may be mentioned that Mr. John H. Wilson, the efficient manager of Adams Express Company in this city, has received from his farm in Botetourt county, some beautiful specimens of pink marble. There has also been discovered on Mr. Wilson's farm iron ore and ochre. —*Alexandria Gazette.*

Low Moor Furnace, Va.,—a Year's Work.

Our last report of the operations of Low Moor furnace, on Chesapeake & Ohio Ry., Alleghany county, Va., published on page 116 of current volume, was to August 13th, the 294th day of its first blast. From August 14th, 1881, to Oct. 22nd, inclusive, the 295th to the 364th day of this the first blast of this furnace, the output of pig iron was about 5,858 tons, from a consumption of some 13,528 tons of lump and wash ore., 6,956 tons of coke, and 6,815 tons of limestone. The stoppages, for repairs etc., amounted to 63 hours; the average weekly output was about 586 tons, or nearly 84 tons a day, including stoppages.

The first year of the first blast of Low Moor Furnace was completed on Monday, October 10th, 1881, as it was blown in on Monday, October 11th, 1880. In consequence of the unusual severity of last winter it was found necessary to bank up the furnace for a few days, therefore it did not complete a year's run until Saturday, October 22nd, 1881. which was the 364th day of its current blast, a day that, it may properly be said, closed the first year of the active life of this the first large modern furnace constructed in Virginia.

During this year Low Moor produced about 25,484 tons of the usual varieties of pig iron–No. 1, No. 2, Mill, Foundry, Mottled, Silvery, etc.,—made by blast-furnaces using brown hematite (limonite) iron ores. In making this amount of pig it used some 60,867 tons of iron ore, or about 2.38 tons to the ton of iron. The quantity of coke consumed in the furnace during the year was about 31,673 tons or 1.24 tons per ton of iron made. The limestone used was about 31,253 tons, or nearly 1.23 tons to the ton of iron. The average make per day, including all stoppages, was a fraction over 70 tons,—a capital average for the first year of such a furnace.

The operations of the year involved the handling and moving, in one way or another, of more than 240,000 tons of iron ore, coal coke, limestone, pig iron and cinders,—a quantity equal in amount to one-fourth of the entire tonnage of the Chesapeake & Ohio Railway during the fiscal year 1879-80. The quantity of coal, iron ore, limestone and pig iron moved for Low Moor during this year of operations by the Chesapeake & Ohio Ry. was not less than 90,000 tons, or nearly one-tenth of its entire tonnage for the fiscal year 1879-80. The Low Moor Company must have moved over its own branch railway, leading to its iron ore mines and limestone quarries, nearly 100,000 tons; and over its service switches at the furnace more than 170,000 tons. More than 125,000 tons of raw materials were raised from the ground to the top of the furnace stack and melted and run out from the furnace.

The coke used is made at the furnace, in 104 beehive ovens, from New River or Lower Measure, No. XII coals, chiefly from the mine of Beury, Cooper & Co., at Caperton, on the C. & O Ry. Low Moor coke, made from this coal, by analysis of J. Blodget Britton, contained: Moisture (absorbed from air after coking) 1.49, volatile combustible matter, 0.58, fixed carbon 94.03, and ash 3.90.—The charge of coal has heretofore been 6 tons to the oven, but the manager intends to increase it to 8 tons.

This company has now upon its pay roll some 800 men, averaging about 600 regularly at work. About 140 families now occupy company houses in the Low Moor village, and before long nearly 200 excellent dwellings will be ready for occupation, enabling the company to secure a population of settled and reliable workmen of all kinds. About 250 men are now working in the company's mines. The population of its estate at this time must be nearly 1,000.

Some idea of the labor involved in the production of pig iron in a large furnace may be formed from a roll, by occupations, of the men employed: there are foremen, keepers, scales-boys, first and second helpers, stovemen, slaggers, weighmen, engineers, firemen and their helpers, scrappers, blacksmiths and their helpers, machinists, stablemen, top and bottom fillers, cindermen, iron loaders, limestone breakers, stock unloaders, ore screeners, mules, office laborers, etc.

What it may have actually cost, as the result of a year's opera, tions, to produce a ton of pig iron at Low Moor, of course we do not know, but from the data we have from time to time furnished we calculate that it was somewhere between $12 and $15. The cost of labor per ton made was between $2 and $3. We published a full description of this furnace, its ores, estimate of cost of making iron, etc., on pages 150 and 169 of our 1880 volume.

The general manager at Low Moor, at this time, is Col. H. W. Goodwin; mining and engineering operations are in charge of Mr. C. F. Conrad, C. & M. E.; and the furnace manager is Mr. Skelding. The furnace is now avering nearly 100 tons a day. Stock is steadily accumulating in the yard, and the demand for the pig made is more than the supply.

Hereafter we shall only publish the pig iron output of this furnace. By the courtesy of its owners, we have been able to lay before our readers most of the details of its consumption of raw materials and of its production for a whole year, the first one of its existence, when, of necessity, it has been compelled to do a large amount of experimental work in becoming familiar with the ores, fuels and limestones, and with the local conditions of a new iron manufacturing region, with men having all these facts to learn and with only raw hands to aid them in carrying on a business large in volume and intricate in details.

Purchase of Great Kanawha Coal Lands.—Dr. David Ward, of Pontiac, Michigan, familiarly known as one of the "Lumber Kings" of the West, (a patron of THE VIRGINIAS) has recently purchased, as we learn from the vendor, Col. H. S. Walker, of Charleston, W. Va., for $135,000, cash in hand, the 4,900 acres of the "Steele Survey," called "Lot B," fronting on the northeast bank of the Great Kanawha river, just above Lock and Dam No. 3 of the U. S. Improvement of the Great Kanawha (see page 105 of the current volume of THE VIRGINIAS), about 22 miles above Charleston and nearly opposite Paint Creek station of the Chesapeake & Ohio Ry.—In June last Dr. Ward purchased some $34,000 worth of coal lands, in the same vicinity, from Mr. Charles C. Lewis, the Cashier of the Kanawha Valley Bank; he has also made small purchases from others, making his recent investment in Great Kanawha coal lands not far from $200,000.

These lands are drained and made accessible by Hughes creek; they now have the navigable Great Kanawha for a highway to market and will soon be on the line of the Atlantic & Northwestern RR., the westward extension of the Richmond & Alleghany RR. Mr. Ward has taken possession of his purchases, and will, we understand, proceed at once to utilize them by mining coal for the western markets.

These lands rise from the Kanawha and Hughes creek to an elevation of 1,050 ft. above the level of the Kanawha, consequently they contain, above the water-level and drainage free for mining, 1,050 ft. of the coal measures, the lower 700 feet, exposing about seven-tenths of the entire thickness of the Middle Measures, No. XIII, and the upper 350 ft. exposing that much of the Upper Measures, No. XIV.—On pages 24 and 48 of our 1880 volume we published a geological section of these lands, made from actual levelings by O. A. Veazey, C. E., from that it appears that he found 10 beds of coal, ranging in thickness from 3.5 to 8 ft. (including beds 4.5, 5.5 and 7 ft.) aggregating 49 ft. of available coal above water-level, in the Middle Measures and below the "black-flint," besides 3 beds, aggregating 12 ft., above the "black-flint" and in the Upper Measures, so that over 60 ft. of thickness of coal—cannel, splint, bituminous, etc.—can be mined here from good workable beds. Three beds of iron ore, corresponding in place to those on Davis creek, were also opened by Mr. Veazey.

Our highly esteemed cotemporary, the *Kanawha Gazette*, in its issue of Nov. 2, after saying that Dr. Ward was perhaps the most welcome visitor the Kanawha valley had had in many years, and commenting on his purchases, adds:

"Dr. Ward we are informed is a gentleman of superior business capacity and has accumulated a large fortune. Other Northern capitalists would do well to reap the benefit of his judgment by making similar investments. The doctor declares his intention of making known to the coal men of his section the immense value of our coal deposits to induce them to come down and invest in our coal lands. He paid a very large sum of money for this property—entirely in cash. The money will remain in our community, and many persons directly or indirectly will feel the benefit of its expenditure here. He is a fair representative of a class of solid, experienced investors, who must prove of infinite value to the future of our Valley and State, and who will be greeted with a hearty welcome by all the people of this section."

The West Virginia Timber Samples, exhibited by the Chesapeake & Ohio Ry. Co. at the late fair of the Va. State Agricultural Society, at Richmond, Va., collected by Capt. Henry C. Lee, Special Agent of C. & O. Ry., attracted a great deal of attention. The samples, both undressed and dressed, of White Oak, Red Oak, Hemlock, White Pine, Tulip-poplar, Ash, Hickory, Maple, curled and other Walnut, etc, were all excellent specimens of first class lumber of the most desirable qualities; they came from the mills of the Greenbrier Lumber Co., at Ronceverte, those of Withrow & Nettleton at Tuckahoe, and those of Bluebaugh & Snow at Hinton, W. Va.

ber of highways by which these coals may reach the great markets,—we may well ask why they have done so if these coals are *inferior?*

What is it, we may ask just here, that makes one kind of coal better than another for a specified or particular use? We may reply that the better coal is (1) The one that, under like conditions, will either do more work, of the particular kind required, doing it equally well, than another coal; (2) That it is one that will do the same work better than another.—(3) It is one that will do more and better work than another. In short, the *superior coal* is the one that is most efficient in accomplishing the particular result for which the coal is used. Its value depends upon the amount of work it can do well; this all must admit.

Bituminous coals—the only ones we have to consider, since the Pittsburg coals and the Great Kanawha coals are all *bituminous* ones—are popularly classified as *gas, coking, steam, foundry, blacksmith, domestic, blast-furnace,* etc., coals; but the same coal is often used for all these purposes,—in fact we believe the "dealers in Pittsburg coal exclusively" claim that it is the very best coal known for all the uses we have named.—Really there are, in a general way, but two kinds of these coals if classified by the uses made of them. They are *gas-coals* and *fuel-coals.* The value of the first kinds is mainly determined by the amount of pure "*volatile combustible matter,*" as the chemists put it, that they contain,—for it is that element that makes the most and the best gas. The value of the second kinds is mainly determined by the amount of pure "*fixed carbon*" that they contain,—for that is the heat-producing element, the ore that is wanted when things are to be heated, evaporated or melted.

The *impurities* that are generally mentioned as impairing the efficiency and so diminishing the value of coals—rendering them for one purpose or another *inferior* or *superior* are—*moisture, sulphur, phosphorus* and *ash.* We suppose that every user of coal would be glad to have an article containing "none of these things," though some of them might want some "moisture" in theirs. Hence the less of these impurities the better.

It follows, from these statements and conclusions,—the general accuracy of which we presume all informed on this subject will concur in,—that the value of coals for different uses can be fairly determined by knowing their composition and physical condition.—In fact, at this time, the question of the value of coals, previous to use, is mainly determined by chemical analyses. Therefore we will first introduce as "matters of fact" and "in evidence" reliable analyses of the coals from several mines in the "Pittsburg bed"—for practically that, in its Pennsylvania area of square miles is the only one that supplies "Pittsburg coal" and "Connellsville coke"—and of the coke made from the same; and also similar analyses of coals from several of the half-dozen or more beds that now furnish the Great Kanawha basin coals that are sent to market, and analyses of cokes made from some of these coals.

Analyses of Pittsburg Coals.—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Water	1.260	1.500	0.950	1.280	1.427	1.517
Volatile matter	30.107	26.060	29.662	38.105	37.980	36.873
Fixed carbon	59.616	64.750	55.901	54.383	54.598	57.200
Sulphur	0.784	1.380	1.931	0.792	0.638	0.710
Ash	8.233	6.310	11.556	5.440	5.357	3.612
Coke, per cent	68.633	.....	69.388	60.615	60.593	61.000

No. 1, Analysis by A. S. McCreath, chemist of Pa. Geol. Survey, of lump coal from Broad-Ford mine of Frick & Co. The ash left in coke from it was 11.995 per cent. "This may be taken as a fair sample of the Connellsville coking coal." Report L., page 63.—John G. Fulton, E. M., the General Mining Engineer of Cambria Iron Co., in a report on coking coal, Report G., page 242, takes this as the "typical" Connellsville coal that makes the best coke.

No. 2 is the "average standard of "best typical coking coals" of Mr. Fulton's report, (G. page 242). He says—"Any excess of volatile matter over 25 per cent is not a necessity."

No. 3 is an analysis, by A. S. McCreath, of "Connellsville *slack* coal," from Broad-Ford mines of Frick & Co. Report MM., p. 22.

No. 4 is of coal from Penn Gas Coal Co's mines, Westmoreland county, by A. S. McCreath. Report MM., page 123.

No. 5 is an average of three analyses of the Penn Gas Coal Co's coal, and No. 6, one of three samples of Westmoreland Coal Co's. coal, by A. S. McCreath. Report KK., page 60.—Of these coals this report says:—On and near the Penn. RR. is the typical gas coal of the country." (p. 60.)—"In the works belonging to both these companies the coal is of exceedingly good quality, and is mined for shipment to be used almost exclusively in the manufacture of illuminating gas," (p. 333).—"The Penn gas coal is the standard." (p. 382.) "The analyses show that the *Pittsburg bed,* as found in the Greene and Washington district, yields a remarkably fine gas coal, the average of 14 analyses giving 37.974 per cent of volatile matter." (p. 382.)

Analysis of Cokes from "Pittsburg coal bed" Coals.—

	*No. 1.	No. 2.	No. 3.
Water	0.032	.....	0.030
Volatile matter	1.296	.....	0.460
Carbon	89.147	87.259	89.576
Sulphur	0.084	0.746	0.821
Ash	9.523	11.995	9.113

No. 1. A typical, verified analysis of Connellsville coke, made from very pure coal, by E. C. Pechin. (Pa. Coke Report L. of 1875, p. 16.)

No. 2. Analysis of coke from Broad Ford mine of Frick & Co., by A. S. McCreath. (L. p. 63.)

No. 3. Analysis of average samples of large quantity of well made coke from Broad-Ford ovens of Frick & Co., by A. S. McCreath. The water was at 225°. (L. p. 78) "The typical good coke." (L. p. 81)

Analyses of Great Kanawha Coal Basin Coals.—The following are analyses of W. Va. coals from the Great Kanawha coal basin—a region about 110 miles long, from 10 to 120 miles wide, and about 6,500 square miles in extent; it includes the New River basin, for New river is the Upper Kanawha:

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Moisture	1.255	0.954	0.76	0.735	2.41
Volatile matter	20.175	26.130	18.65	22.425	24.43
Fixed carbon	77.675	70.883	79.25	75.499	71.82
Sulphur	.....	0.669	0.46	0.536	0.371
Ash	0.895	2.033	1.11	0.805	1.34
Coke per cent	78.570	72.916	.....	76.84	....
Ash per cent in coke	.....	2.788	.....	.....	....

No. 1 is of coal from the 12-ft. "Nelson" bed of Great Flat Top Mountain or Bluestone River (of New River) coal field, by Booth, Garrett & Blair, July, 1881.

No. 2 is of coal from "Crockett" bed of Flat Top Mountain field, by Booth, Garrett & Blair, August, 1881.—This mine was not fairly opened when sampled, it will give a better analysis when fully opened.

No. 3 is of Quinnimont, Fayette county, "lump" coal, by Prof. Thos. Egleston, of School of Mines, New York, August, 1879. An analysis of "slack" coal, made at same time, gave nearly same results.

No. 4 is of the "lump" coal as sold from Fire Creek colliery, Fayette county, by A. S. McCreath, the chemist of Geol. Survey of Pa., who says "It represents a coal of remarkable purity, and it should yield a coke with only a little more than 1 per cent of ash and about one half of one per cent of sulphur." Made July, 1881.

No. 5 is from Elm Colliery, Beury, Cooper & Co., Fayette county, by J. Blodget Britton, Oct., 1881. The water was expelled at 212°. This is the coal used for coke at Low Moor furnace, Va.

	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.
Moisture	1.35	1.03	1.40	0.18	0.93
Volatile matter	25.35	21.38	32.61	38.32	21.83
Fixed carbon	70.66	72.32	83.31	57.20	75.37
Sulphur	0.53	0.27	0.74	.....	0.26
Ash	2.10	5.27	2.15	4.30	1.87
Coke per cent		77.59	65.99	.....	.....

No. 6 is of Nuttallburg coal, Fayette county, by Prof. Thomas Egleston, School of Mines, New York.

No. 7 is of Sewell coal, that from which the coke used at Longdale furnaces is made, by J. Blodget Britton.

No. 8 is of coal from the 11-ft. bed of Hawks-Nest Coal Co., Gauley Mountain colliery,—the coal that will be used for coke in the 150-ton blast furnaces of the Va. Iron & Steel Association, analyzed by Dr. Percy, of the London, Eng., Royal School of Mines.

No. 9 is of coal from upper part of Coal Valley Coal Co's. bed, near Cannelton station, by C. E. Dwight.

No. 10 is an analysis of coal from "Echols" mine, Hawks-nest station of C. & O. Ry., by Prof. J. W. Mallet, of University of Va.

	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.
Moisture.....	2.14	.....	1.32	1.88	2.00	.....
Volatile matter	33.26	38.16	35.20	35.64	40.50	58.0
Fixed carbon	62.61	58.04	61.60	61.07	56.50	23.5
Sulphur.....	0.18	0.72	0.65	....	....	18.5
Ash.....	1.81	3.80	1.87	1.21	1.50	....

No. 11, of "Coalburg" upper coal, by Dr. Doremus.

No. 12, of Davis creek 10-ft. bed of coal, by Prof. S P. Sharples. (See also Prof. Shaler's statement about this coal, on page 154 of this issue.)

No. 13, of coal from lower 5' 8" part of Coal Valley Coal Co's. bed.

No. 14, of Campbell's Creek, Kanawha county coal, by chemist of Riverside Iron Co.

No. 15 of Coalburg "main seam," Kanawha county, by Levette, of Indiana.

No. 16, of Cannelton, Fayette county, cannel coal, by chemist of Manhattan Gas light Co. of New York.—It yielded 12,025 cu. ft. of gas, of 45.6 candle-power, to a 2240 pounds ton.

Analyses of Cokes from Great Kanawha Coal Basin Coals.

	No. 1.	No. 2.	No. 3.	No. 4.
Moisture.....	1.19	0.102	.....	1.08
Volatile matter.....	0.58	0.492	.....	0.69
Fixed carbon.....	94.03	91.940	91.22	60.31
Sulphur.....	0.494	0.538	0.92	0.59
Ash.....	3.90	6.928	7.53	7.92

No. 1 is of coke made at Low Moor furnace from Elm Colliery coal (Beury, Cooper & Co.), Fayette county.—The moisture was absorbed from the air after coking. Analysis by J. Blodget Britton, (Oct., 1881), who pronounced it "undoubtedly a superior coke."

No. 2 is of coke made from the "slack" coal of Fire Creek colliery, Fayette county, by A. S. McCreath, July, 1881. The "ash" is readily accounted for by the fact that all the slate clippings and other impurities of the mine went into the slack.

No. 3, is of Nuttallburg coke, by Prof. C. E. Dwight, of Wheeling, W. Va. It could not have been a fair sample of coke made from Nuttallburg coal, which, as analysis No. 6 shows, contains but 2.10 per cent of ash.

No. 4 is of coke made from coal of 6-ft. "Crescent" bed, of Middle (Kanawha) measures, by Prof. J. W. Mallett, of University of Va., 1877.

(To be continued.)

New River Coals, etc.—In the *American Manufacturer's* editorial account of the proceedings at the late Harrisburg meeting of the American Institute of Mining Engineers, we find the following item:—"In the evening a session was held in Harrisburg, the papers being principally upon chemistry and geology. Quite a lively debate was occasioned by a paper on "The Great Flat-Top Coal Fields of New River," by Maj. Jed. Hotchkiss, Editor of THE VIRGINIAS. He exhibited some remarkable analyses of coals, and stated that a contract was lately made to deliver coke with 95 per cent of carbon or no pay."

"The 95 per cent of carbon" statement was, as reported on page 134 of the Sept., 1881, No. of THE VIRGINIAS,—that M. Soldenhoff had guaranteed "*that 95 per cent of the carbon in the coal used*" should be saved in the manufacture of coke in the improved Coppee ovens that he is constructing for the Hawks-Nest Coal Co.—EDITOR.

The Settled Areas of the Virginias in 1880.

Census Bulletin No. 269, dated Oct. 20, 1881, is devoted to a consideration of the *settled area* or *density of population* in the United States in 1880, considering only the portions that have 2 or more people to the square mile, a limitation that restricts the discussion to the country between the Atlantic coast and the great plains, the region that contained in 1880 over 95 per cent of the total population of the United States.

This region is divided, for discussion, into five classes, according to density of population: (1) From 2 to 6 to a square mile. (2) From 6 to 18. (3) From 18 to 45. (4) From 45 to 90. (5) From 90 on.

The first three groups, it is claimed, indicate a predominantly agricultural condition, since, in a general way, agriculture in the U.S. is not sufficiently advanced to furnish employment and support to a population in excess of 45 to a square mile; consequently the 4th and 5th groups appear only where trade and manufactures exist and where the classes rendering personal and professional services are multiplied.

The first group represents a sparse population mainly sustained by grazing, and in that was in 1790 what is now West Virginia and most of New York, Pennsylvania, etc.—The 2nd group—6 to 18 to the square mile—generally indicates the existence of defined farms or plantations and a systematic cultivation of ground, but in an early shape of settlement or upon soil more or less rugged. This group includes large portions of the mountain country of the Atlantic slope. In 1790 its area exceeded that of the 3rd, 4th and 5th combined.—The 3rd group—18 to 45 to the square mile—almost universally indicates a highly successful agriculture. Here and there the presence of petty mechanical industries raises a difficult farming or planting region into this group, but in general, where manufactures exist at all, they induce a population of 45 or more to the square mile. This was the predominant group in Virginia in 1880; it was also the largest single group in 1790 in the territory that is now Virginia.

The Virginia and West Virginia data relating to areas of settlement in 1880 are given as follows:

	Virginia.	W. Virginia.
(1) Area with 6 to 18 to the square mile	4,100	12,500
(3) Area with 18 to 45 to the square mile	29,025	8,500
(4) Area with 45 to 90 to the square mile	7,000	3,645
Total area of settlement,.....	40,125	24,645

According to the conclusions of this bulletin both of these states have large areas to fill up before they reach the limit of population they can sustain and still continue to be mainly agricultural in their occupations; and both of them have room for almost indefinite expansion in trade, mining, and manufacturing, before even the half of their areas will be absorbed by the 4th group.

According to this bulletin Connecticut and Rhode Island belong entirely and Massachusetts and Ohio, mostly to the 4th and 5th groups; Illinois, Indiana, Maryland, Delaware, and New Jersey belong to the 3rd, 4th, and 5th.—Of the 1,569,570 square miles of area of settlement in the U. S. considered, 384,820 were in the 1st, 373,890 in the 2nd, 554,300 in the 3rd, 232,010 in the 4th, and 24,550 in the 5th group.

The Norfolk & Western RR. received, approximately, $241,673 as gross earnings during Oct. 1881, an increase of $5,963, or 2.4 per cent, over its earnings for Oct. 1880. Its gross earnings for the 6 months of 1881 ending Oct. 31, were $1,139,100, an increase of $103,041, or 9.9 per cent over those of the same period in 1880. The *actual* gross earnings of Sept. 1881, were $8,575 more than the estimated *approximate* ones.

The Local Passenger rates and Local Freight rates (reduced June 1st and Aug. 1st, 1881, respectively, in order to further the local interests of the road) being about 25 per cent. lower than in October, 1880, the above increase in gross earnings is equivalent to an increase of 36 per cent. in the volume of business over that of Oct. 1880. WM. G. MACDOWELL,

Nos. 37-39 S. 3rd St., Treasurer.

Philadelphia, Nov. 7, 1881.

The Metal and Mineral Traffic of the Chesapeake & Ohio Ry. for September, 1880 and 1881.

By the courtesy of General Manager, C. W. Smith, we have been furnished with data, compiled from the records of the company by Auditor of Revenue, Robert H. Fisher, from which we have prepared the following article on the metal and mineral traffic of the Chesapeake and Ohio Railway during September, 1880 and 1881. The returns of the coal and coke traffic of this railway for the same periods are given elsewhere. The quantities are in tons of 2,000 pounds :

	1880.	1881.	Increase.	Decrease.
Pig Iron,.....	1,361	3,908	2,547	....
Iron Ore,.....	2,707	1,874	....	834
Manganese,.....	171	290	119	....
Limestone,.....	1,589	832	....	757
Marble,.....	20	181	161	....
Salt,.....	866	617	....	249
Lime,.....	152	316	164	....
Totals,.....	6,866	8,018	2,991	1,840

The *Pig Iron* movement, by origin and destination, was as follows:

Origin	Destination.	1880.	1881.
Richmond,	Staunton,.....	11	....
	Charleston,.....	..	12
Staunton,	Richmond,.....	52	...
Ferrol,	Huntington,.....	296	....
	Richmond,.....	14	14
	Charlottesville,.....	13	....
	Junction,.....	..	54
	Staunton,.....	..	12
Quinnimont,	Huntington,.....	812	....
	Richmond,.....	27	....
	Junction,.....	27	....
Longdale,	Huntington,.....	110	306
	James River,.....	..	25
	Staunton,.....	..	1,235
Low Moor,	Huntington,.....	..	29
	Richmond,.....	..	270
	Junction,.....	..	29
	Staunton,.....	..	1,923

The Sept., 1881 make of Grace furnace was most of it held at Ferrol; Quinnimont was out of blast for repairs, and so made no shipments; the Longdale shipments were mainly to the West, the one to Staunton being destined to Pittsburg via Valley branch of B. & O. RR.; Low Moor did not go into blast until in Oct. 1880,—its shipments were mainly to Pittsburg via Staunton and Valley RR. of B. & O.

The increase in the movement of pig iron in Sept. 1881 over Sept. 1880, was over 187 per cent,—a result of the large development in iron making on the line of this railway.

The *Iron Ore* movement, by origin and destination, was as follows:

Origin.	Destination.	1880.	1881.
Tolersville,	James River,.....	204	....
Ferrol,	Quinnimont,.....	594	....
Bell Valley,	Quinnimont,.....	13	....
	Ferrol,.....	47	....
Clifton Forge,	Quinnimont,.....	311	....
	Ferrol,.....	70	....
Callaghan,	Quinnimont,.....	592	....
	Low Moor,.....	360	....
Alleghany,	Quinnimont,.....	517	....
Williamson,	Quinnimont,.....	....	212
	Huntington,.....	....	296
Jackson River,	Low Moor,.....	....	57
	Huntington,.....	....	134
Covington,	Low Moor,.....	....	76
Backbone,	Low Moor,.....	....	1,098

The decrease in the movement of iron ore was mainly because Quinnimont furnace, W. Va , which obtains its supply of ore from Virginia, by the C. & O., was out of blast for repairs. The move ment from Williamson was of ore from the Richmond & Alleghany RR., part of it from Clifton Forge and part of it from Big Hill mines; that from Backbone was of ore from the "Stack" bank which in 1880 was credited to Callaghan station.

The *Manganese* movement, by origin and destination, was as follows:

Origin.	Destination.	1880.	1881
Waynesboro,	Staunton,.....	14	....
	Gordonsville,.....	14	....
	James River,.....	117	....
	Huntington,.....	....	13
Charleston,	Staunton,.....	5	....
Huntington,	Richmond,.....	5	....
	James River,.....	17	277

The movement from Waynesboro was the product of the Crimora mine, which now goes to market by the Shenandoah Valley RR: which runs near the mine; that from Huntington was of ore from the West.

The *Limestone* moved in Sept., 1880 was all from Fort Spring, 1,589 tons to Quinnimont furnace and 62 to local stations; that in Sept. 1881, was 832 tons from Fort Spring to Low Moor furnace.

The *Marble* movement was all from Craigsville, from the quarries of the Coral Marble Co. In Sept. 1880, it was 20 tons to Staunton; in Sept. 1881 it was 60 tons to James River, 40 to Waynesboro for shipment via S. V. RR., and 80 to Staunton for shipment via Valley RR.

The *Salt* moved in Sept. 1880 was 281 tons from Richmond and 443 from James River, imported salt, to local stations, and 142 of Kanawha, W. Va., salt from Malden to Huntington; that of Sept. 1881 was 470 tons from James River and 54 from Richmond, imported salt, to way stations, and 93 from Malden to way stations.

The *Lime* moved in Sept. 1880 was 52 tons from Gordonsville, 40 from Fishersville, and 60 from Waynsboro to local stations;—that in Sept. 1881, was 76 from Fishersville and 240 from Waynesboro to local stations. That from Waynesboro was probably from the Rockdale lime works on the Shenandoah Valley RR., Page Co., Virginia.

The gain in the whole metal and mineral movement for the month in 1881 over 1880 was over 17 per cent, and it is a gratifying fact that much of this was in manufactured pig iron rather than in raw materials.

The Mineral Exhibit at the late Fair of the Va. State Agricultural Society, held in Richmond, was the best one we have ever seen on the grounds of that Society; it was an exceptionally excellent exhibition of good samples of the economic minerals of Virginia and West Virginia, and not all a mere show of cabinet specimens. It is much to be regretted that so few persons visited the Fair and saw this fine exhibit of our mineral resources, and that this collection could not have been retained as the nucleus for a permanent exhibition of Virginia minerals.

The Chesapeake & Ohio Railway exhibited a very fine collection of ores, coals, etc, gathered from the line of its road and arranged by its special agent, Capt. Henry C. Lee. It was, by far, the largest and best portion of the entire exhibit. Among its samples we noticed:—Brown hematite and manganiferous iron ores from the Bath Alum Springs, Bath Co., Va., from lands of Joseph Baxter; Red-shale and brown hematite iron ores from R. P. Murray and John P. Haynes, Williamson, Alleghany Co., Va., and the N. Y. Iron & Coal Co., Buffalo Gap Va.; Limestone, from D. Y. Huddleston, Fort Spring, West Va., that used for flux at Quinnimont furnace and for lime-burning at Fort Spring, and also from N. Y. & Va. I. & C. Co., Buffalo Gap, Va.; Manganese, 1st and 2nd grades, from the Crimora mine, Augusta Co., Va., Capt. W. A. Donald, Waynesboro, Va., superintendent; a fine block of Coal 4 ft. 3 inches thick, from the noted "red-ash" Fire Creek mine, Fayette Co., W. Va., M. E. Miller, Staunton, Va., agent; a block of Coal 1 ft. 9 inches cube, from the mine of the Fayette Coal & Coke Co., N. M. Jenkin, manager, Stone Cliff, Fayette Co. W. Va., and very superior samples of 72-hour Coke, from an average charge of 3¼ tons, (the coke used by the New York & Ohio Iron and Steel Co., Ironton, Ohio), made from same coal; Cannel and Block Coals from the well known Cannelton bed of the Cannelton Coal Co., E. S. Hutchinson, Supt., Cannelton, W. Va.; a fine block of Gas Coal 3 by 2.5 by 5.5 feet ft. in size, from Coal Valley mine, Cannelton Station, W. Va.; a yard cube block of Gas and Steam Coal from the highly productive "Crescent" mine of Capt. W. R. Johnson, Crescent, W. Va., also "Peacock" Coal and a fine specimen, 2 ft. by 1.5 of *Stigmaria* from the same mine; a block of Gas Coal from Wyant's Eagle Coal Co., Frederick, Fayette Co., West Va.; and samples of the widely known Splint Coal of the "Coalburg" bed, from the Robinson Coal Co., Neil Robinson, Supt., Coalburg, W. Va.—We doubt if as good a collection as this of gas, cannel, steam, coking and other varieties of bituminous coal could be brought together from any other line of railway in the United States.

The Brighthope Railway Co. made a fine exhibit of bituminous coal from its mines at Winterpock, Chesterfield Co., Va., 32 miles by rail from Richmond. The samples were mined 700 ft. below the surface from a bed 24 ft. thick, the one that

31,483 acres, about 49 square miles of mineral, timber, grazing and farming lands, in fee simple, situated about midway of the length of the famous Shenandoah Valley, extending through 17 miles of its length and 12 of its breadth. These lands are in four principal but nearly connected parcels, (1) The Southwest Massanutton Mountain lands, 22,500 acres; (2) The Shenandoah Iron Works land proper, 6,249 acres; (3) The Blue Ridge lands, 1,720 acres; and (4) The Furnace No. 2 lands, 1,014 acres. The Shenandoah Iron Works tract proper has on it a very considerable village, Shenandoah Iron Works station of the Shenandoah Valley RR., including a half dozen well built and commodious mansions, numermerous dwellings for operatives, a large mercantile establishment, a depot, an excellent church and parsonage, a large bloomary, etc.; it fronts for more than a mile and a half on the South Fork of the Shenandoah which furnishes it a fine water-power.

Catherine furnace and forge and operatives' dwellings are on the Massanutton Mountain tract; these have not been used for some years. Furnace No. 2 and dwellings for the operatives are on the tract of that name; this furnace has been almost constantly in blast since its erection.

In 1870 Mr. Milnes and his associates were incorporated, by act of the General Assembly of Virginia, under a perpetual charter, conferring all the privileges that any mining or manufacturing company could well desire, as The Shenandoah Iron Lumber, Mining and Manufacturing Company

Until within a few months past, in consequence of the lack of transportation facilities, the operations of this company have been of a limited character, running Furnace No. 2, making about 60 tons of charcoal pig iron a week, and the bloomary at Shenandoah Iron works which converted the pig iron made into blooms. The opening of the Shenandoah Valley RR. last April changed all the relations of this great iron property and the more active members of the company at once proceeded to adapt it to these new relations by finding purchasers for the stock that was for sale, thus bringing in new enterprise and capital. In consequence of these changes, a reorganization of the Shenandoah I. L. M. & M. Co. has recently taken place. The officers of this company as now organized are: Alfred Creveling president, John Milnes treasurer, Wm. Milnes Jr. general manager and L.S. Boyer secretary; these gentlemen are the owners of the property.—Mr. Creveling lives in Philadelphia, he is one of the owners of the Chulasky furnace and is president of the Glendower Iron Works, a rolling mill, etc., both in Danville, Pa.; Mr. John Milnes of Philadelphia, is a very large dealer in and miner of anthracite coal; Mr. William Milnes Jr. has lived at and controlled the Shen. Iron Works for many years, he was the pioneer from the North, since "the war," in the purchase and development of Virginia iron lands, and his good sense and sterling character have been of inestimable advantage in the rehabilitating of Virginia and in starting her upon a new career of prosperity; Mr. Boyer of Philadelphia has been a prominent miner and dealer in coal. These gentlemen are now in possession and the work of improvement is now in progress.

From not far above the station the Shenandoah Valley RR. has extended a substantially constructed branch of its road, across the lands of this company, some 3.5 miles to the eastward to the westerly base of part of the Western Blue Ridge, to the line of outcrop of the Primordial or No. I iron ores, where the "Kimball" ore bank (named in honor of the wide-awake, sensible, and energetic president of the S. V. RR.) has been opened, from which over 2,000 tons of lump iron ore have been shipped, since some time last May, to the Swatara furnace, Pa., the Marietta furnaces, Lancaster county, Pa., Lucy furnace, Pittsburg, Pa., and to Hunter & Springer, Chambersburg, Pa.—From this branch railway an arm will be extended about 1.5 miles southeast to Furnace No. 2 and the Fox Mountain iron ore bed, and another about 1.5 miles northeast to the Smith ore bank. Mining operations are now going on at each of these mines, about 80 men being engaged in mining. Fox mountain supplies Furnace No. 2 and ores are shipped to market from the Kimball and Smith banks.

About 40 men are now employed in the construction of a new, modern blast-furnace about a half mile up the mines branch railway and good progress has already been made in the work. This furnace will be 15 feet bosh and 70 feet high; it will have blowing cylinders 100 inches in diameter with 7 ft. stroke, and steam cylinders 42 inches in diameter and 7 ft. stroke; it will be driven by a vertical engine, with fly-wheels 24 ft. in diameter, made by the Shepherd Iron Works of Buffalo, N. Y. The stack will be brick, with an iron jacket, and it will have the Grove iron hot-blast; its capacity will be 60 tons a day. The fuel used will be coke, probably from the Great Flat Top coal—which, in a 10 ft. bed, contains 77.675 per cent of carbon and but 0.895 per cent of ash—which will reach it by way of the New River, Norfolk & Western, and Shenandoah Valley railways which are all parts of one system.

Furnace No. 2, Wm. M. Bowron, F. C. S., manager, is now making about 60 tons of charcoal pig a week from Fox Mountain ores; its entire product is made into blooms at the bloomary of the company, near Shenandoah Iron Works station, where 7 forge fires, and a 20-ton steam hammer are worked by some 30 men. The blooms made command the highest market price, ranking as "neutral" iron; they are now sold to Baltimore, Harrisburg and Pottstown, Pa., Wilmington, Del., etc.

An outcrop, many feet in thickness, of the neutral brown hematite iron ores that in Virginia are so abundant as stratified deposits in the upper member of the Lower Cambrian or Potsdam group of rocks, Rogers' No. 1, runs for 4 miles in a northeast-southwest course, across the lands of this company, on the westerly flank of the broken ranges that here form the Western Blue Ridge; thence they have a general dip to the westward and underlie a large portion of this company's extensive domain. At Fox Mountain bank this bed has proven to have a thickness of over 80 feet. In the Cub Run basin of the Massanutton chain, near Catherine furnace, is a bed of red shale Clinton (No. V.) iron ore, from 20 to 30 feet thick, that underlies Cub Run valley, as a synclinal trough, for 7 miles, outcroping on each side of the valley and enclosing a belt of Lower Helderberg (No. VI) limestone. Besides there are other ore basins in this chain. There is no question but that this company has vast stores of the best of iron ores, so disposed as to be readily and cheaply mined.

In 1878 the Hon. Wm. Milnes, Jr., furnished the writer the following statements of the cost of making iron at the Shenandoah Iron Works at that time.

1. The actual cost of producing a ton of hot-blast charcoal pig iron at Furnace No. 2., was as follows:

Fox Mountain iron ore, 2.1 tons at $1.66 per ton	$3.50
Charcoal, 110 bushels at 5 cents per bushel	5 50
Limestone, from 450 to 500 pounds	.18
Cost of raw materials	$9.18
Labor, wear, interest, and hauling to forge 5 miles	6.82
Total cost per ton, delivered at forge	$16.00

2. The cost of producing a ton of pig iron whenever coke could be had by rail (as it can be now) it was estimated would be as follows:

Fox Mountain iron ore, 2.1 tons at $1.66 per ton	$3 50
New River coke, 1 ton	5.00
Limestone, 450 to 500 pounds	.18
Labor, incidentals, etc	2.07
Total cost per ton, at furnace	$10.75

At the time of making these statements Mr. Milnes had been engaged there in the successful and profitable manufacture of iron from Jan. 1866 to Jan. 1878, having in the meantime made over 25,000 tons of iron.

All the existing conditions at Shenandoah Iron Works are favorable for the cheap production of high grade iron, and we confidently anticipate its profitable manufacture there in large quantities by midsummer of the coming year. We also hope to see there some of the shops of the Shenandoah Valley RR. Co. for the manufacture of cars, as well as other shops that will work up into more valuable forms the iron that will be manufactured there.

New River RR. consolidation.—Meetings of the stockholders of the Bluestone RR. Co., the New River RR., Mining and Manufacturing Co., and the East River RR Co., are called to meet at Hinton, on C. & O. Ry., W. Va., at noon, Dec. 22, 1881, to "authorize and make a merger" of these companies into the New River RR., M. & M. Co. The meeting is called by Thomas Graham, F. J. Kimball, Wm. G. Macdowell, Geo. R. W. Armes and W. C. De Armond, a majority of the Board of Directors.

Great Kanawha, West Va., Iron Ores and Coals.

The Black-Band Iron and Coal Co.—*By Prof. N. S. Shaler, S. D.*

Position and Topography.—This tract of land, which I am credibly informed contains within one boundary an area of 3,500 acres, lies upon the headwaters of Davis creek in West Virginia. Davis creek is an affluent of the Great Kanawha river entering that stream from the south at a point about four miles below Charleston, a town of 4,000 inhabitants. From the mouth of the creek to the northern border of the tract is about 10 miles; from Charleston to the eastern border of the land is about 7 miles.

The general topography of this tract of land is as follows: Originally the surface formed a table land of considerable height, elevated about 700 feet above the Great Kanawha river; into this table land the numerous branches of Davis creek have cut deep ravines with steep sides. These ravines are now about 300 feet below the flat-topped ridges that lie on either side. As these ravines are numerous, the surface of the area is very much broken; for agricultural purposes, this is a disadvantage, but for the needs of the miner it is a very favorable disposition of the ground. From the main Davis creek it is easy to get access to all parts of the land by the side valleys, at least 10 miles of the hillsides containing the valuable iron and coal beds are thus made accessible to tramways.

Soil and Timber.—The greater part of the surface of this field is covered by a rather deep though not very fertile soil. This soil is well adapted to the growing of tobacco and fruit, but is not well suited for grains, especially with the bad system of agriculture pursued in this region. In time it will have its value for tillage, but at present I cannot deem it worth reckoning upon.

The forest growth is of excellent quality, and occupies at least nine-tenths of the surface. I have rarely seen a better average of timber than it affords; of walnut there is very little, but of the other valuable woods the supply is large and of excellent quality. Ash, Poplar, White and Chestnut Oaks, make up the greater part of the forest. All these woods are now becoming rare in regions adjacent to transportation. From a rough computation I am inclined to believe that it will be possible to net from $15 to $30 per acre from this timber, and that the forest may be trusted to furnish from the small and unmerchantable trees, enough timber for all mining uses.

Coal and Iron.—All the mineral deposits of this district exist in the shape of beds which lie in nearly horizontal attitudes. There is a gentle slope of the beds in a westerly direction not exceeding on the average about 40 feet to the mile; about enough to secure good drainage to the mines.

As yet there has been no actual mining done upon this land and the explorations are, with few exceptions, limited to a few open and shallow drifts upon the best known coal and iron beds. None of these beds are disclosed on the surface; they are hidden beneath the thick coating of "wash" or detritus and the deep soil. The existing openings have not been made on any careful system of levelings, but their positions have been by chance indications in the way of "blossoms" or fragments in the stream beds. Although this work has been very skillfully done by Captain Hovey, the amount exposed has been insufficient to exhibit the numerous valuable deposits of this area.

So far these explorations have shown the existence of at least three seams of coal sufficiently thick for working above the drainage level of the valleys; of these, but one is sufficiently well shown to make its character quite clear. This is an admirable bed. Its general character is given in the section below:

7. Shale at top of section.	Total coal, 7 feet 7 inches.
6. Coal 36 inches.	
5. Fire clay 12 inches.	
4. Coal 39 inches.	
3. Fire clay 12 inches.	
2. Coal 16 inches.	
1. Fire clay at base of coal	

I am inclined to believe that this coal will make a coke suitable for smelting iron. I am led to this opinion by its behavior in an open fire, where it behaves just as the best coking coals do. A practical test can be made at a small cost. The general appearance of this coal as well as the analyses made of it show it to be admirably suited for steam and household use. It will stand exposure in the open air without slaking, as is shown by the condition of the coal lying at the mouth of the drifts. I am satisfied that it will be possible to net a royalty of about 10 cents per ton on this coal, besides a small profit on the cost of carriage to the river. The yield will be from 6,000 to 8,000 tons per acre, according to the method of mining. The Federal Government is now improving the Great Kanawha river and within four years it will be possible to reckon on transportation to Cincinnati and Louisville for at least eight months in the year. I am satisfied that this coal can be forwarded in competition with any known to me in this region. It seems to me probable that at least 2,000 acres of this tract contain this bed, so that on the basis of 4,000 tons per diem of output this mine would not be exhausted in half a century.

There are several other beds of coal known upon the property, but they are not well explored and as yet merit no discussion. The general reputation of the Kanawha valley coals is good, and all the experience in mining in the district shows us that they may be trusted to maintain this character in an even way over large areas.

Iron Ore.—We come now to the consideration of the iron ores of the property. These consist of several different beds varying widely in their character. In the upper part of the ridges we finds beds of iron oxide in the shape of the well known block ores which have been the basis of the iron industry of the Hanging Rock district for half a century. They seem to me to be as well developed as in the district about the mouth of the Big Sandy river, where they have been used for making car-wheel iron for many years. They contain in a raw state about 40 per cent of metallic iron and the phosphorus carry is always low. There ores could be profitably used in the manufacture of car-wheel iron as soon as access to them by railway is secured. They will have greater value as mixing ores to be used along with the Black-Band ores.

At a lower level on the property, at a height of about 100 feet above the main level before described, there is another iron ore which appears as an oxide, but will probably be found to be a carbonate at any distance from the surface. This ore is badly exhibited; at the one point where it has been cut open it appears to be over 2 feet thick. I believe that it will be found of workable thickness and good quality, as soon as the entries are driven far enough into the hill to escape the action of the atmosphere.

I am inclined to believe that this property contains other deposits of a similar nature that have not yet been sought for except in the beds of the streams. There are few rocky exposures, the deep bed of soil and detritus covering the whole property.

The above-named iron ores, would of themselves afford as good a basis for an iron industry as is possessed by many of the furnaces in the Ohio valley, and would, I believe, warrant the effort to develop the property. Considerable as they are, they seem insufficient to be compared with the main iron ore of the property, the Black-Band of its name.

The Black-Band ore is essentially a carbonaceous shale or impure coal containing a large percentage of iron. The iron is in the form of a carbonate. Five openings have been made in the search for this deposit and in four of them it has been found distinctly and uniformly developed, in the other opening the iron is too small in quantity for profitable working.—The general character of this deposit may be inferred from the following section, which is found on the Brushy branch of Briar creek.

Sandstone.
Ferruginous shales with streak of coal.
Lean ore 2 feet.
Slate 8 inches.
Black-Band ore 4 feet.

The three other openings that show the ore have substantially the same character. The principal coal is always found at about 15 feet below the base of the ore, and the thin streak of coal above the deposit seems always to be purest. The good ore is always between 3 and 4 feet in thickness; in Dunlop hollow, which is probably near the centre of the basin, the workable ore exceeds 4 feet in thickness.

The quantity of the ore as determined by the assays of Mr.

The Production of Bread-grains in Virginia in the 8th, 9th and 10th Census Years.

A recent "extra bulletin" of the Census of 1880 gives the Cereal Production of the U. S. at the 10th Census, that for the year 1879, in bushels, by counties; from that and from the Census reports of 1870 and 1860 we have compiled the production of bread-grains in each of the grand divisions of Virginia (divisions by grouping of counties as in Hotchkiss' Summary of Virginia, 1876, and as grouped for tobacco statistics in the Sept., 1881, number of THE VIRGINIAS.)

The following table gives the *Production of Wheat* at each census named:

Grand divisions	1860.	1870.	1880.	
	Bushels.	Bushels.	Bushels.	Acres.
1. Tidewater	2,524,435	754,353	903,873	110,697
2. Midland	2,941,641	1,536,424	1,451,307	184,772
3. Piedmont	2,295,596	1,922,457	1,851,671	214,899
4. Blue Ridge	117,393	72,852	124,177	22,507
5. The Valley	2,621,535	2,714,426	2,976,068	295,164
6. Apalachia	331,528	388,247	495,285	69,252
7. Trans-Apalachia	16,272	10,028	20,123	3,516
Totals	10,848,400	7,398,787	7,822,504	900,807

In 1880 Virginia ranked as the 16th state in the production of wheat. She ranked above all the other southern states except Kentucky and Missouri. Her production was about 1-57th of that of the United States, which was 459,479,505 bushels.

The Virginia crop of 1880 was about 6 per cent more than that of 1870. Accepting the area of Virginia as 40,125 square miles, as in recent Census bulletins, about 1-29th of the State was cultivated in wheat in 1879. The largest divisional area in wheat in 1879 was in The Valley, which had nearly 1-3rd of the acreage; it also produced nearly 3-8ths of the crop of the state. Tidewater gained well over its 1870 crop, so did the Blue Ridge and the Apalachias; Midland and Piedmont lost in yield. Tidewater, Midland and Piedmont were still far below their 1860 production, the Blue Ridge more than regained its position. The Valley gained nearly 4 per cent in 1870 over its production of 1860, and nearly 10 per cent in 1880 over that of 1870. Apalachia also had a steady and excellent gain in production at each decade, especially in 1880 over 1870. Trans-Apalachia has also more than regained its place in 1860.

The Average Production of Wheat, per Acre, in bushels, in each grand division of Virginia, and in the state in 1879, (the census of 1880) was as follows:

1. Tidewater	8.16	5. The Valley	10.08
2. Midland	785	6. Apalachia	7.15
3. Piedmont	8.61	7. Trans Apalachia	5.72
4. Blue Ridge	5.51	8. Virginia	8.66

According to these returns The Valley lead among the grand divisions in the production of wheat to the acre; it was followed, in order, by Piedmont, Tidewater, Midland, Apalachia, Trans-Apalachia and Blue Ridge. The average in the state and in Piedmont were nearly the same.

The Production of Wheat per capita in each grand division of Virginia, in bushels, at each census named, was as follows:

	1860	1870	1880		1860	1870	1880
1. Tidewater	7.31	2.17	2.15	5. The Valley	13 49	13.71	11.87
2. Midland	7.92	4.22	3.26	6. Apalachia	4.83	5 34	5.39
3. Piedmont	10.97	9.27	7.44	7. Trans-Apalachia	2 22	1.17	1.49
4. Blue Ridge	4.79	2.55	3.13				
				8. Virginia	8.89	6.03	5.17

It appears from the above that the production of wheat per capita, in Virginia as a whole, has steadily declined at each decade, until in 1880 it was only about what the consumption of bread-grain per capita would have been if all the bread used in the state had been made from wheat flour, which is not the case, for a large portion of the bread used in many portions of this state is made of corn meal.—All the grand divisions except Apalachia have shared in the decline in production per capita.

(To be continued.)

The Recent Opening of the Richmond & Alleghany RR. was attended by the following prominent gentlemen from other states—many of them we are pleased to know, interested financially in this railway and in other Virginia enterprises: Hon. Wm. H. Barnum, Ex-Senator, of Lime Rock, Conn; J. D. Badgley, of New York city; Isaac T. Burr, President of the National Bank of North America, Boston, Mass.; Geo. M. Bartholomew, President of Charter Oak Life Insurance Co. Hartford, Conn.; Parker C. Chandler, Pres. Danville, Olney & Ohio River RR., of Boston, Mass.; Chas. H. Coffin, hat manufacturer, 548 B'way, New York city; Alonzo B. Cornell Governor of the State of New York; Jacob Edwards, Treas., of Bates Co., Boston, Mass.; Jas. G. De Forrest, retired merchants, of 37 West 36th St., New York city; J. Mansfield Davies; Dan'l Dewey, of the firm of Gray, Dewey Gould & Co., Boston, Mass.; Wm. S. Eaton, 8 Pemberton Square, Boston, Mass.; Dan'l P. Eells, Pres. of Ohio Central RR. Co., Cleveland, Ohio; W. J. Eaton, Treas. National Tube Works, Boston, Mass.; Gen'l Thomas Ewing, of Ohio; Wm. Frazier, of the Virginia, Kentucky & Ohio RR. Co., Boston, Mass.; Hon. Henry F. French, Assistant Secretary of the Treasury, Washington, D. C.; Jos. H. Gray, of the firm of Gray, Dewey Gould & Co., wool merchants, Boston, Mass.; G. G. Hadley, Gen'l Manager of Ohio Central RR., Toledo, Ohio; Col. Wm. H. Harris, Director of Ohio Central RR., Cleveland, Ohio; Thomas M. Hart, Pres. of Mt. Vernon Bank, Boston, Mass.; Prof. C. H. Hitchcock, Prof. of Geology, Dartmouth College, and State Geologist of New Hampshire, Hanover, N. H.; E. C. Homans of the firm of E. C. Homans & Co., Bankers, No. 2, Wall street, New York city; Sheppard Homans, Treas. Poughkeepsie Iron Co., No. 2 Wall street, New York city; J. K. Humfreville, Banker, No. 42 Broadway, New York city; Henry D. Hyde Esq., Attorney at Law, Boston, Mass.; H. A. Jones of Poughkeepsie Iron Co., Poughkeepsie, N. Y.; R. C. Kearns, of St. Louis, Iron Mountain & Southern RR. Co.,; Hon. John S. Keyes, of Concord, Mass.; Jas. S. Lowrey, manufacturer of men's furnishing goods, 85 Mercer street, N. Y.; Emory McClintock, Actuary N. W. Mutual Life Ins. Co., Milwaukee, Wis.; R. M. Morse Esq., No. 15 Central street, Boston, Mass; E. A. Nichols, Deputy Collector, No. 21 Cortland St., New York; Jos. H. Parsons, Pres. St. Nicholas Bank, Wall Street, New York city; Hon. Wm. A. Richardson, Ex-Secretary of the Treasury, Washington, D. C.; C. H. Sanford, Manufacturer, Bridgeport, Conn.; Sam'l Shethar, No. 548, Broadway. New York city; Chas. E. Soule Esq., Attorney at Law, No. 169, Broadway, New York city; J. C. Snowdon, Boston, Mass; Wm. P. Shinn, Metallurgist, recently of St. Louis, now of New York city; J. Nelson Tappan, City Chamberlain, New York city; Geo. C. Thomas, Philadelphia, Pa.; Wm. P. Ward, New York city; Jos. D. Weeks, Pittsburg editor of the *Iron Age*, Pittsburg, Pa.; Franklin B. White, Boston, Mass.; Dr. G. H. Wynkoop, Hunter's Point, Long Island; Henry Whelan of Philadelphia, Pa.; Prof. Edward Youmans, Editor of *Popular Science Monthly*, New York city.

The Lumber Traffic of Chesapeake & Ohio Ry. for September, 1880 and 1881, from which freight revenue was derived, in car-loads of 10 tons each, 2,000 lbs. to ton, was as follows:

Point of destination,	1880	1881
James River, for export and domestic coastwise,	307	352
Richmond City,	105	122
Charlottesville, and north and south, via Va. Midland RR.	5	24
Waynesboro, and north and east, via Shen. Valley RR.	68	23
Staunton, " " via Valley Br. of B & O.	48	35
Huntington and west, via Ashland & Ohio river,	42	176
Local points on C & O Railway	118	159
Total car-load,	694	891

This statement shows that the increase of the lumber traffic for September, 1881 over same month of 1880, was was 197 car-loads, or about 30 per cent. The development of business at both termini of the railway, and also for Richmond trade and local use continues to indicate a large increase.

The above does not include the transportation of ties or other lumber for the Company's use.

C. & O. Lumber Dept. Wm. L. Rawson, G. A.

The Virginia Midland RR. now has its engineers in the field in the North Mountain region, west of the Shenandoah valley, in Frederick and Shenandoah counties, Va., and Hardy and Hampshire counties, W. Va., exploring for a route for the extension of its Manassas Branch from Strasburg, its present terminus and junction with the Valley Branch of the B. & O. or its vicinity, to the westward, through the iron ore fields of Va. and W. Va., to the coal fields of W. Va.,—either due west to the North Branch Potomac coal fields, to a connection with the new partially constructed W. Va. Central and Pittsburg RR. in Grant county, W. Va., or southwest to the Great Ohio River coal basin itself at the head of Gauley and Elk rivers in Pocahontas and Webster counties W. Va.

We have it from the very best authority that this extension will be begun as soon as the engineers have located the route. Col. J. S. Barbour has the enterprise and a proper appreciation of the advantages that will accrue to the Virginia Midland by this extension, converting a now paralyzed arm of that road 63 miles in length, into its most important feeder. Heretofore the means have been wanting by which he could bring about this most desirable extension; now the "Clyde syndicate" has become a factor of means in the question and the extension will at once be made. It is gratifying to know that this wealthy corporation that now controls more thon 560 miles of Virginia railway, is not unmindful of the fact that its interests will be best promoted by developing the resources of the country traversed by and tributary to it; and that it is not entirely carried away by the delusion that the best interests of the owners of railways are subserved by neglecting the business that is near at hand and caring for that which is far away.

A glance at the geological map of the Virginias (See June 1880, No. of this journal) makes it evident that this westward reaching-out of the Virginia Midland can be made a very profitable one. The air-line distance from Strasburg—a place but 90 miles by rail from the harbor of Alexandria—is only about 50 miles from the North Branch of Potomac coal-field, one abounding in the best of coals, judging from the reports that have recently come to us from that quarter; and it is only about 100 miles of air-line from the same place to the great Ohio Basin coal-field in Pocahontas or Webster. Within a few miles of Strasburg, as the same map shows, it will reach Shenandoah-Cacapon group (of Hotchkiss' Geography of Virginia) of Upper Silurian (Nos. IV to VII) mountains and valleys, that in Frederick and Shenandoah counties, Va., and in Hardy county, W. Va., abound in iron ores, especially in the red-shale and fossil ores of No. V, the Clinton rocks, which in the southwestern part of this group, in Shenandoah county, have the most remarkable development of these ores the writer has ever seen or heard of; some of its stratified beds of ore are 15 ft. and even more, in thickness, samples of which, by analysis of Prof. Genth, contained 55.48 per cent metallic iron, 0.207 manganese, 0.072 sulphur, and 0.026 phosphorus,—ore so cheaply mined that it is delivered at a furnace for $1 a ton.—Farther to the west it will reach the Warm-Springs Mountain and the Jackson River or Highland groups of Upper Silurian rocks, also rich in iron ores.

We have not space at this time to dwell upon the details of the character of the routes this extention might take, or to particularize the resources of the country such routes would traverse.—We can only say that in our opinion, based on a somewhat extensive knowledge of the region in question, that this company would consult its own best interests and at the same time promote the most important ones of the country that will become tributary to its extended railway, by following, in a general way, first the valley of Cedar creek, passing the mines of the old ante-Revolutionary Zane's furnace and forge and its by-no-means exhausted ore banks, a number of large tanneries, beds of iron ore and manganese, and the now prosperous and productive Van Buren furnace and its numerous developed beds of iron ore and limestone, to the head of Cedar ereek, running west of the Shenandoah Valley and between the Little North and the Big North mountains; then passing a divide, lying between these mountains, to the valley of Stony creek and then along that, by the great ore banks of Columbia Liberty and Henrietta furnaces, and by Liberty and Henrietta furnaces; thence across to North Fork of Shenandoah, in same range of mountain valleys, by the ore deposits of the Brock's Gap country, (See page 140 of THE VIRGINIAS for 1880), and then up the N. E. Fork of N. Fork of Shenandoah, following the old route of trade and travel, to Lost river and on to the South Branch of the Potomac, Moorefield and the North Fork of South Branch Potomac and across to the coal-fields. This is the line of abundant resources, one that can sustain a first-class railway with its local business. Its route presents some engineering difficulties, but they are small when compared with the freightage the region traversed can furnish a railway. (See statement about Low Moor furnace freight on page 148 of this issue.)

We recently passed over a line of railway, the Harrisburg & Potomac, passing through somewhat similar valleys, behind the Western Blue Ridge (locally called South mountain), east of the Cumberland valley, in Pa.; a road built merely to reach iron ores and furnaces. We are quite sure that the line we suggest would not be more difficult to construct, and are equally sure it would find more to carry. Too many of our railways have been located away from instead of along and near our great beds of minerals, and now they are compelled to build and maintain costly branches to reach the things that should have been near their main line. We could name one Va. railway that runs for 10 miles in a "poverty valley," without any resources of value, when it might have run the same distance along and near the outcrop of a heavy bed of excellent iron ore, in a parallel valley but separated from its present line by a high ridge; the valley traversed yields it nothing, the one it should have traversed could furnish it 20,000 tons of freight yearly.—A few miles more of length of line are nothing provided each added mile can furnish a mile of something that can be marketed by the railway.—Wisely located local railways are the the ones the Virginias most need now, and they are the ones that will pay best.

Purchase of Kanawha Coal Lands.—We learn from a reliable source that Mr. H. C. Frick, one of the leading coal and coke operators of Pittsburg and Connellsville in western Pennsylvania, with one or more associates, has purchased, after a careful and thorough exploration, the Loup Creek tract of coal land, about 35,000 acres, in Fayette county, W. Va., lying not far from the line of the Chesapeake & Ohio Railway, and extending from below Loup creek almost to Laurel creek (Cotton Hill station) a distance of 12 miles, that at a moderate expense can be secured as railway frontage, though not really necessary, since Loup creek drains most of the tract and by way of its valley access is easy to the Chesapeake & Ohio and to the navigable Great Kanawha.

It has for some time been a matter of surprise to us that bituminous coal lands in Pa., containing but two or three beds of workable coal, and remote from transportation and from market, should sell for hundreds of dollars per acre, when lands with four times as much workable coal, equally good in quality and greater in variety, all lying above water-level, on and near the Great Kanawha, an important navigable river, where one line of trunk railway is completed and another is in progress, and 200 miles nearer western markets, can be bought at from $25 to $50 per acre.

We are pleased to note that capitalists are beginning beginning to find out our better field for investment. Within a few months large tracts of coal lands have been bought by such substantial and careful investors as A. A. Low of New York, Theodore Wright of Philadelphia, David Ward of Detroit, John Woolridge of Boston, and H. C. Frick of Pittsburg. We know of negotiations now pending with other men of large means and business capacity. It will not be long before the Great Kanawha coal field will come to its rightful place, one in the front rank of coal production.

Southwestern Virginia is attracting the attention of British capitalists. In no long time her enormous amount of splendid timber, covering mountains to their summits and extending along deep canyons, her boundless coal seams and other minerals, will bring industry and wealth to thousands. During the past fortnight an examination of several Virginia estates has been made by Mr. Finley Dun, Mr. George Hunt, and Mr. James Black, of London, England, who pronounce themselves well satisfied with their appearance and varied resources. It is understood that these gentlemen, who have been in Washington recently, are negotiating to purchase 400,000 acres in West Virginia for colonizing purposes. Mr. Finley Dun, of the party, was formerly employed by the London *Times* in writing up foreign agricultural resources.—*Lynchburg Virginian, Nov.* 9, 1881.

Coal and Ore Development in the Virginias

From "Our Philadelphia Letter" of Nov. 2, 1881, of *The American Manufacturer* of Pittsburg, Pa., we make the following extracts:

"Unusual attention is being bestowed upon the development of coal and ore properties in New Jersey, Pennsylvania, Virginia and West Virginia. Pittsburg parties were here last week, and have arranged conditionally for the purchase of a large ore tract in Virginia. Operations will be commenced during this month. The condition is that an examination will bear out the representations. This tract has been already thoroughly tried and will bear the examination of the experts now on the ground. Several other tracts are in negotiation. This is becoming a favorite method of investment here. The old Quaker stock which sat down on the fine estates in this city a generation or two ago, know what a comfortable thing it is to own a few thousand acres of land which must become exceedingly valuable by the expansion of population and the increasing requirements of the country. The investors are anticipating the course of events and are buying largely of the choice lands in the four states mentioned. Some of the steel rail companies have also concluded highly satisfactory terms for the mining and delivery of ores and fuel. The president of one of the new companies developing Virginia resources, told me today that there were under contract 300 miles of railroad passing through mineral lands in the two Virginias and depending on the future traffic in and transportation of minerals for business. Blodget is still overrun with business, and has several expert assistants at work."

"We learn from Mr. T. Burnham, 407 Walnut street, Philadelphia, of the discovery of a large vein of specular iron ore in Buckingham county, Virginia. The vein at the surface is four feet wide, and at a depth of twenty-three feet it is nine feet wide. A branch of the Richmond and Alleghany railroad is being now built from New Canton, on the James river, to Lynchburg, and will pass through or very near this property. The following is an analysis of the ore from a depth of 23 feet:

IRONMASTERS' LABORATORY,
PHILADELPHIA, October 24, 1881.

Samples of Specular ore from Buckingham County, Va.

Pure metallic iron,			53 88
Oxygen with the iron,			23.09
Water,			.61
Silica,			16.26
Sulphur,			none.
Phosphoric acid	Phosphorus,	.027	....
	Oxygen,	.034	.61
Alumina,			1.43
Lime,			.07
Magnesia,			.05
Oxide of manganese,			4.03
Titanic acid and oxide of copper,			none.
Undetermined matter and loss,			.419
			100.000

J. Blodget Britton, in speaking of these ores, says they should be classed as "Bessemer." "

The Winifrede Coal Co. has been incorporated with a capital of $150,000, with E. M. Davis, James Albright, Theodore Wright, H. H. Houston and A. R. Little, all of Philadelphia, Pa., as corporators, for the purpose of owning and working the "Winifrede" coal lands, some 12,000 acres, that were purchased last July by Theodore Wright of the firm of Peter Wright & Sons, of Philadelphia, owners of the American Steamship line.

The lands of this company lie between Field and Slaughter creeks of the Great Kanawha, reaching to within about a mile of that river and of the Chesapeake & Ohio Ry., and extend southwardly to within about a mile of Coal river, the Kanawha-Coal divide cutting the tract into nearly equal parts. The coal formerly mined on this tract was highly esteemed in the West and Southwest for domestic and steam purposes. A railway (to be operated by a separate company) of standard-gauge, about 5¼ miles long, with 56 pound steel rail, is now being rapidly pushed to completion to connect the mines of this company with the Chesapeake & Ohio Ry. and with the Great Kanawha. At the same time the mines are being put in working order, so the "Winifrede" coals will soon appear in the markets again.

Fuel Consumption in making Pig Iron.—In the Bulletin of the American Iron & Steel Association for Sept. 1, 1881, appears a communication from Taws & Hartman, blast-furnace engineers, giving the results of the best running, for 6 consecutive weeks, of 9 prominent furnaces in different parts of the U. S.; workings ascertained chiefly to answer the question whether "in this country a ton of pig iron had been made with a ton of fuel; or whether it is possible to make a ton of iron from best Lake Superior ores with a ton of fuel." The furnaces reported are not named.

The 9 furnaces varied in bosh from 11 to 20 feet, in height from 56 to 80 ft., in consumption of fuel from 2,227 pounds to ton (2,268 lbs) of pig to 2,987, in consumption of ore to ton of pig from 2,481 pounds to 4,816, in consumption of limestone to ton of pig from 983 pounds to 2,240, and in heat of blast from 750° to 1,371°; the carbon per cent in the fuel used (5 using coke and 3 anthracite only and one using mixed coke and anthracite) varied from 82 to 94.

The second best record of fuel consumption among the nine furnaces is that of the one designated as "No. 2," a number that translated means *Longdale Furnace, Alleghany county, Virginia.* We are quite sure that our highly esteemed and eminently conservative friends, the managers of Longdale, did not give us the key for finding "which-is-which" among the nine and in the maze of figures representing them. We found it in the 94 per cent of "carbon in fuel" that marks No. 2 of the list, a percentage 6 greater than any other given and 14 greater than that of the least one.—*Coke with 94 per cent of carbon*, in so far as we are at present advised, is made from the West Virginia New River coals only, and Longdale is "booked" for having made a ton of iron with less than, or about a ton of coke.

The record of "No. 2," as given in The Bulletin, is: Bosh 11 ft., height 60 ft., fuel to ton of pig 2,264 pounds, carbon in fuel 94 per cent, ore to ton of pig 4,816 pounds, limestone to ton of pig 1,355 pounds, pig iron ton used 2,268 pounds, quality of pig iron made Nos. 3 and 4, heat of blast 750°, fuel used coke.

The furnace that used 2,227 pounds of fuel (the only one using less than No. 2) was an 18 by 78 furnace using 2,610 pounds of ore and 1,030 of mill cinder to the ton of iron and having a blast-heat of 1,150°.—No. 2 used more ore to the ton of pig than any other of the furnaces of the list, and, all things considered, its record is the best one given.

All wrong.—The Ironton *Register* says: "Lowmoor furnace, Virginia, will make 2,000 tons of iron, using a mixture of two-thirds native and one-third Lake Superior ores. If the venture proves satisfactory, it will probably continue the use of foreign ore for mix."

This is news from a far country. Low Moor does not propose to do what is stated. It has an abundance of ores of its own, two varieties, brown hematite and red-shale, both near the furnace, and has no need of other ores to enable it to make first class irons, such as it is now making and the demand for which it cannot meet.

German Carp in Va.—A "leather" German carp less than 12 months old, taken from a lake in Central Park, Petersburg, Va., was 16 inches long and weighed about 2 pounds, says Robin Adair in the *Richmond Dispatch.*—In Feb. 1881 ten young "mirror carp, about 3 inches long, were put into the ice pond of the Va. Deaf, Dumb and Blind Institution, Staunton, Va.; they subsisted entirely on the vegetable and animal life of the pond. When the water was drawn from this pond July 29, 1881, all these fish were found alive and fat, each over 10 inches long and weighing about 1.5 pounds. *The Goodson Gazette.*—Prof. Spencer F. Baird, U. S. Fish Commissioner, has had placed a lot of German Carp at the disposal of Col. M. McDonald, Commissioner of Fisheries for Va.,—whose address is Washington, D. C., care of Smithsonian Institute,—who will send them, without cost, to Va. applicants until his supply is exhausted.

Copper.—Dr. McIlhenney, Washington, D. C., writes us, Oct. 27, that he has purchased some large tracts of land in the Blue Ridge, in Madison and Page counties, Va., on which he has developed some superb deposits of copper ore which he is now working.

Real Estates, Water Power, &c.

MAGNIFICENT WATER POWER, FOUNDRY, MILLS, &c.

For Sale in Danville, Virginia.

Pursuant to a decree of the Corporation Court of Danville, Va., in the chancery cause of W. J. Crews against Rodenhizer's administrator and heirs, we offer at private sale, until the 20TH DAY OF DECEMBER, 1881, the entire

WATER POWER, FOUNDRY, AND MACHINE SHOP, MILL SITES, &c.

now owned by Corbin & Crews, and Crews & Rodenhizer's heirs, particularly described in the bill and exhibits filed in said cause.

For further information address undersigned at Danville, Va.

Notice will be given in case of sale privately, but if not sold privately before, we will on the

20TH DAY OF DECEMBER, 1881, AT 11 O'CLOCK, A.M.,

sell on the premises, in Danville, said

Water Power, Foundry, and Machine Shops, Mill and Sites, &c.

at Public Auction to the highest bidder.

The property will be first offered in different lots, with fine water power attached to each, and then as a whole, and the Commissioners reporting the highest aggregate bid.

This magnificent water power, supplied with water by canal from Dan river, is capable of wonderful development, in addition to its present capacity, which is ample.

TERMS:—Fifteen per cent of the purchase money to be paid cash, the residue in three equal installments of one, two and three years, the purchaser to give bonds for the deferred payments, bearing six per cent interest from the day of sale, and when the purchase is completed, and on the compliance with the terms of sale, the title to be conveyed to the purchaser, and the purchaser to convey back the property in trust to secure the deferred payments. If desired, application will be made at once to allow any purchaser to pay all his purchase money cash.

This is a splendid opportunity to parties desiring sites for cotton, woolen, grist, flour and rolling mills, foundries, &c., &c., and nearly all kinds of manufactories in the growing city of Danville.

E. E. BOULDIN, E. B. WITHERS, Danville, Va. } Comm'rs.

Immediately after the above sale is through I will sell the patterns and machinery, &c., belonging to the old established foundry and machine shop of forty years standing. Terms made known at the sale.

W. J. CREWS,
Last surviving partner of Crews, Bodenhizer & Co.
oct and nov.

THE PAINT CREEK MINING Properties of Kanawha County, West Virginia.

PAINT CREEK MINING CO., (On west side of Paint Creek.) **10,000 acres.**

WACOMAH MINING CO., (Adjoining the lands of othe Co., but mainly on the east of Paint Creek.) **4,700 acres.**

PAINT CREEK RAILROAD CO. (From mouth of Paint Creek up the same.)

All under one management with same directors and same stockholders holding same ratio of interest in each company.

L. L. CONRAD, of Baltimore, ...President.
GEORGE W. RIGGS, of Washington, ...Treasurer.

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L. L. Conrad, of Baltimore.
Geo. W. Riggs, of Washington.
H. H. Parker, of New York.
John S. Barbour, of Alexandria, Pres't Va. Midland RR.
James F. Patton, of Union, Monroe Co., W. Va.
Wm. H. Edwards, of Coalburg, Kanawha Co., W. Va., Pres't of Kanawha and Ohio Coal Co.
Isaac N. Smith, Charleston, Kanawha Co., W. Va.

Isaac N. Smith, of Charleston, Kan. Co., W. Va., ...Solicitor.
Oscar A. Veazey, of Paint Creek, Kan. Co., W. Va.,..Engineer.

These companies have been organized for the development of valuable coal loads owned by them. They are now constructing a first-class railway through the properties, having its terminus in the pool above Lock and Dam No 3, part of the improvements now being constructed by the U. S. Governmen on the Kanawha River. This railway will be completed and equipped for transportation of coal in September, 1881. It crosses the C. & O. Ry. and connects with it, so that shippers will have every facility for both river and railway trade.

The companies are prepared to make leases to reliable parties and to ship the coal of their lessees to river and rail upon most favorable terms.

Their Cannel, Splint, Bituminous and Coking Coals are unexcelled in quality, quantity and size of workable seams—the principal splint coal seam averaging ten feet.

Application for leases may be made to the President direct or through any of the Directors.

More particular information given upon request, by mail or otherwise, to L. L. Conrad, President, 15 Lexington street Baltimore, or Isaac N. Smith, Charleston, Kanawha county, W. Va., Solicitor of the Companies.

THE OLD BLACKFORD FORGE PROPERTY,

Including Water-power and Over 600 Acres of Land,

On Hawksbill Creek, Below Luray, Page County, Virginia,

And on line of Shenandoah Valley Railroad, is hereby offered for sale. For terms, etc., address

Lock Drawer 2, Staunton, Va.

PAINTS AND MANGANESE.

I offer for lease, on liberal terms, the deposits of **Manganese and Mineral Paints,** consisting of Ochre, Umber, Terra di Sienna, Carbonate of Iron, &c., upon my estate near Fishersville Depot, on Chesapeake & Ohio Railway and line of Shenandoah Valley Railroad, in Augusta county, Virginia. Examination invited. Correspondence may be had with the undersigned at Fishersville, or his counsel, Thomas D. Ranson at Staunton, Va.

SAMUEL H. STEELE.

WESLEYAN FEMALE INSTITUTE,

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One of the first Schools for Young Ladies in the Union. Climate unsurpassed. Buildings elegant, Surroundings beautiful. With twenty teachers and officers. Attended present session (1880–81) by 120 boarding pupils, representing seventeen States.

Terms moderate. For catalogue, address

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COKING COAL LAND FOR LEASE

625 ACRES OF NEW RIVER COKING COAL LAND can be leased for a term of fifteen or more years, upon a royalty of seven cents per ton (of 2240 lbs) with option of purchase, to parties who are responsible, and willing to begin work at an early day.

Address G. M. BLUME,
Fayette, Station, Fayette Co., W. Va.
Sept. and Oct.

RESIDENCE IN STAUNTON FOR SALE.

I offer for sale the Residence of Mrs. Virginia B. Donaghe, fronting on three of the principal streets—Main, Lewis and Frederick—in immediate proximity to business, churches, schools, &c. The improvements are first-class, and the property one of the best, if not the very best in the city, either as a home or a speculative investment. It will be subdivided if not sold as a whole. Examination invited.

Terms:—Ten per cent cash, and balance at one, two, and three years, with semi-annual interest.

THOMAS D. RANSON

FIRST-CLASS CHARCOAL FURNACE,

Now in blast, with stock and fixtures, for sale. Makes the best car-wheel iron.

Also, 50,000 acres of land in one tract, 12 miles from A. M. & O. RR. Contains splendid timber, Manganese Ore, and Brown Hematite Iron Ore, ***free from phosphorus and sulphur,*** **suitable for making best car-wheel iron. Will sell in sections of 5,000 acres or more, or as a whole. Title guaranteed and no squatters. For full report, address,**

D. S. PIERCE,
Wytheville, Va.

COAL AND TIMBER LANDS FOR SALE OR LEASE.

The undersigned, as President of a Land Company, has for sale or lease, on favorable terms, some of the best coal and timber lands in the New River District, on the line of the Chesapeake and Ohio Railway. The coals on these lands are the **Coking Coals,** the coke from which is now so much in demand for blast-furnace and other metallurgical uses. For further information and terms, apply to

SAMUEL COIT, President,
Hartford, Connecticut.

TIMBER LANDS FOR SALE.

I offer for sale an undivided one-fourth interest in 64,781 acres of timber lands, in Wyoming Co., Va., and situated on a branch of the Guyandotte river.

The land is heavily timbered and abounds in COAL AND OTHER MINERALS. The other three-fourths are owned by Northern capitalists.

For further information and terms, address,

WM. HEALD,
212 W. Falls Avenue, Baltimore, Md.

JAMES RIVER SPECULAR ORE PROPERTY FOR SALE.

We offer the fee simple in the MINERAL RIGHTS on 750 acres of land, immediately on the James River Canal and the Richmond & Alleghany RR. This property is situated a short distance below Riverville, in the heart of the magnetic and specular ore belt of the James River Valley. It is one of the most valuable iron ore properties now on the market—the deposits being very large, and the ore of the purest quality. Price $16,000.

A. D. ROBERTSON & CO.
6t 84½ Main Street, Lynchburg, Va.

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ROANOKE COLLEGE, Salem, Va.

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Expenses for a session of forty weeks, including college fees, board, fuel, lights, and washing, vary from $160 to $220.

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The Catalogue will be sent on application.

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WASHINGTON & LEE UNIVERSITY.

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Full courses in Classical, Literary, and Scientific Studies, including those of the professional degrees of Civil Engineering and of Law.

TERMS:—Tuition and other fees in all the Departmentst $70. Board, Lodging, &c., per month, from $12 to $20.

The next session begins September 16th, 1880, and ends June 22d, 1881.

For other particulars apply to J. L. CAMPBELL, Jr.,
Clerk of Faculty, Lexington, Va.

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REV. J. I. MILLER, A. M., . . Principal

The Twelfth Session of this school will open the 1st Monday in September, and continue Forty Weeks. With all the equipments of a first-class school, the cost of a pupil is far below that of most schools of like grade, because of more moderate rates, but especially on account of the economy that is required of ALL pupils in DRESS, PRESENTS, SHEET MUSIC, &c. The cost of a pupil for Board, Tuition in Literary Course, Washing Lights, and Furnished Room, for ten months, $210. Extras FEW and MODERATE. Send for circulars and catalogue.

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Supplies, by a well arranged curriculum, full studies for an ACADEMIC DEGREE, and makes liberal provision for the SPECIAL instruction of the CIVIL and MINING ENGINEER and GEOLOGIST. The Superintendent has been unable to meet the demand for graduates, upon remunerative offers, as Civil Engineers.

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Superintendent.

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RATES GREATLY REDUCED AGAIN TO SUIT THE TIMES.

BOARD $2.00 AND $2.50 PER DAY. Fire Proof. Accommodates 400.

This splendid new hotel is situated in the heart of the city, and adjoining the beautiful Capitol Park, with its Statuary, Monuments, Fountains, Groves, and Flower-beds; is newly and elegantly furnished throughout. It is convenient to all the Depots and Fine Coaches run to and from all the Stations and Steamboat Landings.

Special suits of rooms will always be kept in readiness for wedding and other large parties.

Notice.—The delightful climate of Richmond is unsurpassed, thereby claiming the attention of tourists and invalids.

VIRGINIA HOTEL, STAUNTON, VIRGINIA.

The "Old Reliable." The People's Favorite. Complete in all its Appointments.

The Only First-class Hotel in the City. Rates Reduced to $2.00 and $2.50 per day.

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Manufacturers of Bar and Loop Iron, Railroad Spikes, Fish Plates, and Bolts. Also, Machine Work of all descriptions. SPECIALTIES:-Blast Furnace and Rolling Mill Machinery, Hydraulic Cotton Screws, Mining Machinery and Bridge Work of all kinds. Office, 319 Walnut Street, Philadelphia.

Mining and Civil Engineers.

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Wytheville, Virginia.

The Mineral Lands of Southwest Virginia, in the Blue Ridge, Valley, and Apalachian Districts a SPECIALTY. Correspondence solicited.

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Mining & Civil Engineer;

Quinnimont (C. & O. R'y), W. Va.

Mineral and other Lands Surveyed, Mapped, and Reported on; Mines opened, surveyed, &c. Is located in the New River Coal Region.

E. C. VINCENT,

Civil Engineer;

No. 14 W. Main St., Staunton, Va.

Engineering and surveying of all kinds promptly attended to

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The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

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The Virginias,

PUBLISHD MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor,

At 346 E. Main St., Staunton, Va.

Terms. including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising. per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

Entered at Staunton, Va., Post-office, as second-class matter.

Rogers' Va. Geological Reports.—Persons having copies of these reports for 1836, 1837, 1838, 1839 or 1840, that they will sell at a fair price, can find a purchaser by addressing Jed. Hotchkiss, Staunton, Va.

The Virginias for 1880, substantially bound, with the 18 extra pages of maps and sections (including a full geological map of Virginia and West Virginia, in 10 colors,), complete, with index and title page, will besent, prepaid, to any address in the U S., *on receipt of Three Dollars.*

Black Band Iron & Coal Co.—We are informed that the acreage of coal and iron land owned by this company is 3,500 acres, and not 1,501 as we stated in our Oct. number.

Davis Creek, W. Va,, Iron, Coal and Timber lands, adjoining and similar to those of the Black-Band and Terragenta iron and coal companies, which were fully described by Professors Sharples and Shaler in our October number, are in this issue offered for sale by Mr. William Frazier, Trustee. A capital opportunity for making a judicious and profitable investment is given by the offer to sell these lands. We desire to especially recommend them to those wishing to purchase a timbered property containing both iron and coal. Mr. F. also offers to sell a share of the very valuable coal and timber land adjacent to the falls of the Great Kanawha, and a share in the grand water-power afforded by those falls; also fine timber and grazing lands in Roane county, W. Va.

Personals.—Mr. Wm. Frazier, Contractor of Virginia, Kentucky & Ohio RR., has moved his office from Washington, D. C., to 64 Equitable Building, Boston, Mass. Mr. J. L. Meigs, Consulting Engineer, has the same address.

Col. Oliver A. Patton, of W. Va., now sojourning at 138 Fifth Avenue, New York, in the interest of mining matters in the Virginias, in acknowledging the receipt of a full file of THE VIRGINIAS which he had ordered, writes us:—"I have long felt that you have done more for the material interests of the two Virginias than any half dozen men in or out of them, and I sincerely hope you will realize the full results and the hopes which have inspired your great work."

Prof. S. P. Sharples, the State Assayer of Massachusetts, publishes his professional card in our advertising columns this month. Prof. S. has a most excellent reputation as an analytical chemist; in the report on Black-Band Iron ore by Dr. Shaler of Harvard University, which appeared in our October number, he calls Prof. Sharples "one of the most competent of our living assayers." We agree in this endorsement and hope those of our readers having analytical work to be done will get this competent assayer to do it.

Coming into use in the West.—The Chesapeake & Ohio road brings Ashland every day large quantities of coke from Fire Creek, Nuttallburg and Stone Cliff, West Va. It brings ten cars of coke daily from Eagle to the Norton Iron Works; also some eight or ten cars of iron ore from Backbone, Virginia, for the Norton, and from three to six cars every day for the Etna and Belfont furnaces at Ironton.—Ashland, Ky., *Independent*, Nov. 10, 1881.

The Shenandoah Valley RR. has hands at work at Shenandoah Iron Works, Page county, Va., digging foundations for workshops that are to be located at that place, says the *Warren Sentinel.*—We intimated that this would probably be done in our last issue.

The Baltimore & Ohio RR. has placed the people of Staunton and of the whole Shenandoah Valley near its Valley Branch under obligations by its "winter schedule," by which it began to run on the 21st instant. By taking the 7 A. M. train here at Staunton, passengers arrive at Harper's Ferry at 12-15 P. M.; Washington 2-05 P. M., Baltimore 3-15 P. M., Philadelphia 7-45 P. M., and New York 10-45 P. M. of same day, only changing cars at Baltimore for Philadelphia or New York.—That is, leaving here at 7 A. M., Washington is reached in 7 hours, Baltimore in 8, Philadelphia in 13, and New York in 15 hours.

For going westward the arrangements are equally good. Leaving Staunton at 7 A. M., Pittsburg is reached in 15 hours, at 10 P. M.; Cincinnati in 23 hours, at 6-30 A. M.; St. Louis in 35 hours, at 6 P. M., and Chicago in 35 hours, at 7-15 P. M.

The Baltimore & Ohio would add to our obligations and to its popularity if it would arrange and give us as good a schedule in this direction from New York, Philadelphia, Baltimore and Washington. As it now runs it takes 9 hours and 45 minutes to run from Baltimore and 8 hours and 20 minutes to run from Washington to Staunton, taking 1 hour and 20 minutes more to run from Washington and 1 hour and 45 minutes more to run from Baltimore in coming this way than in going that.

The "fast mail" of the Virginia Midland that leaves Washington at 11-20 A. M. reaches Lynchburg at 4-55 P. M. with the New York papers and mail of the same morning. The Baltimore & Ohio train leaves Washington at 8-40 A. M. and reaches Staunton at 5 P. M. and *does not bring* the New York papers of the same day—in fact, with three railways northward they do not reach here until the morning after their publication.—We hope the B. & O. can arrange for the connections from New York now made by the Va. Midland. It is about as far from Washington to Lynchburg as it is from Washington to Staunton, and the B. & O. has some advantages for running in its favor.

The Crown Hill Splint Coal Co., of which Brewer Smith is Superintendent, mines the noted "Coalburg" splint coal seam on the Hansford lands near Paint Creek station of Chesapeake & Ohio Ry., 72 miles from Huntington, W. Va., and 348 from Richmond, Va., and just below Lock and Dam No. 3 ot the U. S. improvement of the Great Kanawha. The Coalburg seam on this lease ranges in thickness from 4 ft., on the top of the slate, on the river front to 6 ft. 4 inches on the back line.

Chesterfield Coal and Coke.—Jewett & Brother have had several offers for the fine seam of coke discovered on their land at Coalfield, but they intend to mine it themselves. Jacob Baach is successfully working a coal mine in the same vicinity; The old Midlothian mine belonging to the Burrough's estate is being successfully worked; it and another mine in Chesterfield are worked at a depth of 1,000 feet.—*Richmond Dispatch*, Nov. 12, 1881.

Iron Ore and Marble, Frederick Co., Va.—The iron ore on Mr. Fritts' land, five miles from Winchester, is not only abundant, but of very fine quality, and it improves as the vein is developed. We believe the day is not far distant when the hills west of this city will teem with laborers engaged in developing their hidden wealth.

In the same neighborhood (on Mr. John Lupton's farm, less than four miles from town), is as fine marble as Tennessee or any othes portion of America can produce.—*Times.*

The Areas of Virginia in 1880.

An extra Census Bulletin, devoted to showing the areas of the States of the United States, that of the Counties of the States, etc., by Henry Gannett, E. M., Geographer of Tenth Census, dated Sept. 30, 1881, has recently been issued.—From that we compile the following statements about Virginia. The author omits from his areas "the 3 nautical miles from the shore" that, as he admits, are under the jurisdiction of the adjacent state; but he includes in his "gross areas" (judging by the boundary line on the small scale map of the U. S. accompanying the Bulletin) the waters included between lines extended from headland to headland. The areas were calculated by "square degrees."

In consequence of the uncertainty of the location of the Va.-W. Va. boundary line it says: "The position of the boundary between Virginia and West Virginia is not known within several miles, leaving sufficient latitude for an error of several hundred square miles in each state. Whatever may be ultimately taken from the area of one, by a correct location of this boundary, will be added to the other."

Summary of Land and Water Areas in Virginia and in the United States, in square miles:

	Virginia.	United States.
Coast waters (bays etc.),	1,780	17,200
Rivers and smaller streams,	520	14,500
Lakes and ponds,	25	23,900
Total water surface	2,325	55,600
Total land surface	40,125	2,970,000
Gross area	42,450	3,025,600

According to this summary Virginia has, compared with the whole Union, nearly 1-10th of the coast waters area, 1-29th of the rivers area, 1-956th of the lakes area, 1-24th of the total water surface, 1-74th of the total land surface, and 1-72nd of the gross area — Florida has 1,800 square miles of coast waters, Maryland 1850, New York 3,260, and Texas 2,510; each of these has more than Virginia.

Virginia ranks 9th in river area, 8th in total water area, 34th in total land area and 32d in gross area, among the states and territories.

The notes to this summary state that Virginia "includes no portion of the Potomac river."—A statement somewhat incorrect, since the adjudicated Md.-Va. boundary gives Virginia all the indentations of the Potomac on her side of the river, the boundary extending from headlands to headlands. Her area, as calculated, "includes the various inlets along the Atlantic coast and the interior portion of the Chesapeake bay from Smith's island (of the bay) to the sea."

The authorities used for Virginia's boundaries were: Coast Survey maps for the N. C., the Atlantic coast, the Chesapeake bay, and the Potomac below Washington; for other lines Colton's maps and the Eclectic Geography maps,—the latter in the Eclectic Geography of Virginia by Jed. Hotchkiss, published by Van Antwerp, Bragg & Co., of Cincinnati.

Lake Drummond is the only inland lake in Virginia that is mentioned; its area is given as 16 square miles. The river areas given for Virginia appear to us to be too small. The bulletin states that "the area of river surface has proved a difficult matter to determine, even approximately." The plan pursued for determining these areas was to find the areas in states that have been surveyed by the U. S. General Land Office and so get a comparative proportion for "river surface" and "land surface" and from that proportion estimate for the unmeasured states.

The areas of the counties of Virginia, in square miles, are given below. We have arranged them by grand divisions, placing the counties together in natural groups, and not in alphabetic order. Of course these areas are only approximations, for the maps relied upon for information are grossly inaccurate, and then the areas obtained from them are "corrected arbitrarily" to make them "add up" the total area of the State.—We give the information because it will be that referred to for some time to come. The list is defective in that it omits Dickenson county, organized in 1880, and gives the areas of Russell, Wise and Buchanan as they were before that county was taken from them. It is agreeable to see that the bulletin spells all the names of our counties as our best writers do, except Mathews and Spotsylvania, in each of which it persists in doubling the "t" contrary to "good usage" in Virginia.

1. Area, in square miles, of Tidewater Grand Division Counties; the counties grouped, mainly, by peninsulas.

Counties.	*Areas.*	*Areas of Groups.*
1. King George	180	
2. Westmoreland	170	
3. Richmond	140	780
4. Northumberland	180	
5. Lancaster	110	
1. Essex	300	450
2. Middlesex	150	
1. King-and-Queen	360	
2. Mathews	100	740
3. Gloucester	280	
1. Caroline	500	770
2. King-William	270	
1. Hanover	440	
2. New-Kent	210	
3. James-City	150	1,020
4. York	70	
5. Warwick	100	
6. Elizabeth-City	50	
1. Henrico	280	470
2. Charles-City	190	
1. Prince-George	300	
2. Surry	325	
3. Sussex	400	2,325
4. Southampton	610	
5. Isle-of-Wight	290	
6. Nansemond	400	
1. Norfolk	480	860
2. Princess-Anne	380	
1. Accomac	480	780
2. Northampton	300	
30. Total area		8,195

2. Area, in square miles, of Midland Grand Division Counties; the counties grouped by river basins.

Counties.	*Areas.*	*Areas of Groups.*
1. Alexandria	40	
2. Fairfax	440	1,170
3. Prince William	430	
4. Stafford	260	
1. Spotsylvania	380	850
2. Louisa	470	
1. Fluvanna	270	530
2. Goochland	260	
1. Buckingham	690	
2. Cumberland	280	
3. Powhatan	280	2,930
4. Chesterfield	500	
5. Appomattox	280	
1. Prince-Edward	300	660
2. Amelia	360	
1. Dinwiddie	540	840
2. Nottoway	300	
1. Lunenburg	400	
2. Brunswick	580	1,310
3. Greensville	330	
1. Campbell	450	
2. Charlotte	500	
3. Pittsylvania	900	3,260
4. Halifax	800	
5. Mecklenburg	610	
25. Total area		10,650

3. Area, in square miles, of Piedmont Grand Division Counties, the counties grouped by river basins.

Counties.	*Areas.*	*Areas of Groups.*
1. Loudoun	520	1,240
2. Fauquier	720	
1. Culpeper	400	
2. Rappahannock	240	
3. Madison	320	1,520
4. Greene	200	
5. Orange	360	
1. Albemarle	680	
2. Nelson	460	1,570
3. Amherst	430	
1. Bedford	840	1,560
2. Franklin	720	
1. Henry	400	940
2. Patrick	540	
14. Total area		6,830

4. Area, in square miles, of Blue Ridge Grand Division Counties, —those of the Blue Ridge Ridge plateau.

Counties.	*Area.*	*Area of Group*
1. Floyd	320	
2. Carroll	540	1,320
3. Grayson	460	
3. Total area		1,320

5. Area, in square miles, of The Valley Grand Division Counties; the counties grouped by the river basins to which they mainly pertain.

Counties.	*Areas.*	*Areas of Groups.*
1. Frederick	380	
2. Clarke	320	
3. Warren	250	
4. Shenandoah	510	3,480
5. Page	320	
6. Rockingham	900	
7. Augusta	900	
1. Rockbridge	780	1,330
2. Botetourt	550	
1. Roanoke	280	280
1. Montgomery	450	
2. Pulaski	340	1,310
3. Wythe	520	
1. Smyth	490	980
2. Washington	490	
15. Total area		7,380

6. Area, in square miles, of Apalachia Grand Division Counties; the counties grouped by the river basins to which they belong.

Counties.	*Areas.*	*Areas of Groups.*
1. Highland	400	
2. Bath	750	
3. Alleghany	500	1,950
4. Craig	300	
1. Giles	490	890
2. Bland	400	
1. Tazewell	400	
2. Russell	540	2,010
3. Scott	520	
4. Lee	550	
10. Total area		4,850

7. Area, in square miles, of Trans-Apalachia Grand Division Counties.

Counties.	*Areas.*	*Area of Group.*
1. Buchanan	510	
2. Dickenson	...	900
3. Wise	390	
3. Total area		900

Recapitulation of areas of land surface of Grand Divisions of Virginia, in square miles

Grand Divisions.	*Areas.*
1. Tidewater	8,195
2. Midland	10,650
3. Piedmont	6,830
4. Blue Ridge	1,320
5. The Valley	7,380
6. Apalachia	4,850
7. Trans-Apalachia	900
Total land area of Virginia	40,124

The water surfaces in each county are excluded from the areas as given above.

The states that have about the same land surface as Virginia are Kentucky with 40,000, Ohio with 40,780, and Tennessee with 41,750 square miles.

The states that have about the same land surface as some of the grand divisions of Virginia are: Massachusetts with 8,040 square miles, and New Hampshire with 9,005, are each about equal in land extent to Tidewater. Maryland with 9,860 square miles and Vermont with 9,135 have each about the same area as Midland. New Jersey with 7,455 square miles is about the same size as The Valley or Piedmont. Rhode Island with 1,085 square miles of land is smaller than the Blue Ridge grand division Connecticut with 4,845 square miles of land is very nearly equal in extent to Apalachia. Delaware with 1,960 square miles is something more than twice as large as Trans-Apalachia; but that grand division, properly measured, has about as much land as Rhode Island with its 1,085 square miles.

The Areas of West Virginia.

Elsewhere we give, from an Extra Bulletin of the Census of 1880, the land, water, etc., areas of Virginia and the land surface area of its counties; the explanatory statements made in that article apply equally to West Virginia, so we will not repeat them.

The square miles of Land and Water Areas in West Virginia, according to the census of 1880, are:

	Square Miles.
Rivers and smaller streams	135
Total land surface	24,645
Gross area	24,780

West Virginia has about 1-119th of the total land surface and about 1-121th of the gross area of the United States. It ranks 39th in gross area and also in total land surface among the states and territories as organized in 1880.

It is stated that this state includes "half of the boundary portion of the Big Sandy river, and all of the boundary portion of the Ohio river." The authorities relied on for boundaries were Colton's and the Eclectic Geography maps, and the Land Office Map of Ohio.

1. The Valley counties have the following areas:

Counties.	*Areas.*	*Area of Group.*
1. Jefferson	250	570
2. Berkeley	320	
2. Total area		570

2. The Apalachian counties, grouped by river basins, have these areas:

Counties.	*Areas.*	*Areas of Group.*
1. Morgan	300	
2. Hampshire	630	
3. Mineral	300	3,100
4. Hardy	700	
5. Grant	520	
6. Pendleton	650	
1. Tucker	340	1,420
2. Randolph	1,080	
1. Pocahontas	820	
2. Greenbrier	1,000	
3. Monroe	460	3,080
4. Summers	400	
5. Mercer	400	
13. Total area		7,600

3. The Trans-Apalachian counties, grouped mainly by the river basins in which they are principally situated, have these areas:

Counties.	*Areas.*	*Areas of Groups.*
1. Preston	650	
2. Monongalia	360	
3. Marion	300	
4. Taylor	150	
5. Harrison	450	3,(2)
6. Barbour	360	
7. Upshur	350	
8. Lewis	400	
1. Hancock	100	
2. Brooke	80	540
3. Ohio	120	
4. Marshall	240	
1. Wetzel	440	
2. Tyler	300	1,190
3. Doddridge	300	
4. Pleasants	150	
1. Woods	375	
2. Ritchie	400	
3. Wirt	290	2,035
4. Roane	350	
5. Calhoun	260	
6. Gilmer	360	
1. Jackson	400	400
1. Mason	360	
2. Putnam	320	
3. Kanawha	980	
4. Clay	390	
5. Braxton	620	5,770
6. Webster	450	
7. Nicholas	720	
7. Fayette	750	
9. Raleigh	680	
10. Boone	500	
1. Cabell	300	
2. Lincoln	460	2,220
3. Logan	800	
4. Wyoming	660	
1. Wayne	440	1,300
2. McDowell	860	
39. Total area		16,475

Recapitulation of the area of the land surface of the Grand Divisions of West Virginia, in square miles.

Grand Divisions.	*Square Miles of Area.*
1. The Valley	570
2. Apalachia	1,600
3. Trans-Apalachia	16,475
Total land area	24,645

This is 135 square miles less than the gross area (24,780 square miles) of this State, for that includes the water surface.

Comparing the land area of West Virginia with that of other states of the Union it appears to be about five times larger than Connecticut, two and a half times larger than Vermont, New Hampshire or Maryland, three times larger than Massachusetts, three

times larger than New Jersey, and nearly twelve times larger than Rhode Island. Its Valley grand division is more than half as large as Rhode Island; its Apalachian is about the size of Massachusetts or New Jersey; and its Trans Apalachian (a region all underlaid by bituminous coals) is more than four times larger than Connecticut, eight times larger than Delaware, more than one and a half times larger than Maryland, Vermont or New Hampshire, and nearly half the size of Indiana.

Pittsburg vs. Great Kanawha Coals.

(Continued from Page 149.)

As we expected, our able Pittsburg cotemporary, the *American Manufacturer*, comments on the portion of this article published in our October number, in its issue of Nov. 25th.—With its customary manly way of doing it embodies these comments in its "Coal and Coke Trade Report," in the place where it has been in the habit of assertiug the "superiority" and "indispensableness" of Pittsburg coal. We recognize this open and fair way of dealing by returning our thanks for it.—Before resuming our article we will pay our respects to what it has to say concerning what we have said. It comments as follows:

"Exception has been taken by *The Virginias* to the assumption in the MANUFACTURER that the Pittsburg coal is superior to any other in the Ohio valley. Nothing unfair or disparaging to the great mineral product of West Virginia was intended by our assumption, but merely to give a fact that everybody was entitled to know. *The Virginias* gives the analyses of numerous coals, the product of Virginia mines. These we doubt not are correct. But our assumption was not grounded upon the deductions of chemistry; it was made and warranted by the superior test of practical experience. Pittsburg coal commands ever and always one cent a bushel more than any other coal in all the markets of the Mississippi Valley, and besides, it is exclusively used for making gas in all the works in the same valley, even at Wheeling, Parkersburg and Huntington, together with all the places where gas is used on the Gulf and Atlantic coast, save northward where it is met by the Liverpool coal, its only equal, we believe, as yet discovered in the world. At all the interior cities, Cumberland, Washington, Harrisburg, Williamsport, Buffalo, Syracuse, Albany, &c., the same coal is relied upon in their gas manufactories. And—but we may be mistaken—we think it is used at Richmond, Petersburg, Norfolk, and pretty much all other gas-making places in our country, and that it is only superseded by Liverpool coal where that can be obtained the cheapest."

In the above extract *The American Manufacturer* disclaims any in tention of being "unfair or disparaging the great mineral product of West Virginia" in its "assumption that the Pittsburg coal is superior to any other in the Ohio valley." We grant it the benefit of its declaimer, but think that it and all impartial readers will concede that the following extracts from some of its trade reports—widely circulated and copied as they are and as they, barring this matter, deserve to be—for the current year (to go back no farther) certainly had a tendency to disparage the Great Kanawha coals—in fact it generally mentions them by name—and, by contrast, to unduly magnify the character and importance of those from Pittsburg, manifestly to the disadvantage of those from the Great Kanawha, and all in a way that fully justified our previous conclusions.

Extracts from American Manufacturer for 1881 *in reference to Great Kanawha coals.*

"Though not equal to the Pittsburg coal, they will be good substitutes in time of need."—Feb. 18.

"These supplies assist materially in preventing the dearth that would exist were the entire dependence upon the Monongahela mines—though what is called Pittsburg coal is still the favorite with all classes of consumers."—April 1.

"Were it not for the superior quality of the Pittsburg coal for various essential uses the river trade would be gradually superseded by the West Virginia, Ohio and Kentucky coals."—July 15.

"When this is ascertained (That the Davis Island dam would interrupt navigation) and known the price of Pittsburg coal will probably go materially higher, and many of those depending upon it will cast about among the Virginia, etc., deposits for fuel to supply its place as far as possible."—July 29.

"The present high rate will not be materially increased, as inferior coals are made to take the place of Pittsburg for pretty much all uses except for making gas."—Sept 9.

"During the late rise in the Kanawha about 1,000,000 bushels got out into the Ohio and accomplished the voyage to Cincinnati. This godsend and the regular import by rail from the Hocking valley, place that city beyond the reach of unsuppliable want. Louisville is also nearly as well protected by Kentucky coal within accessible distance. The main consideration in the matter grows out of the superiority of Pittsburg coal for all purposes, and to be without it is exceedingly inconvenient—for gas manufacture it is indispensible."—Sept. 29.

We were more than surprised when we read this in our cotemporary's rejoinder:—"THE VIRGINIAS gives the analyses of numerous coals, the product of Virginia mines. These we doubt not are all correct. *But our assumption was not grounded upon the deductions of chemistry;* it was made and *warranted by the superior test of practical experience.* (Italics ours.)

Great shade of Robert Hare! Is it possible that a trades-journalist can, in the year of grace 1881, thus write and deliberately publish in Pennsylvania, *the chemical State* of the Union, the one that is the home of Dudley and Drown, that contains such analytical laboratories as those of Booth, Garrett and Blair and J. Blodget Britton, that sustains a chemical laboratory with such a chemist as McCreath in charge of it, and one that has, we presume, more chemists than any other State of the United States constantly engaged in determining by "chemical deductions" the values and adaptabilities of coals and cokes, of oils and ores, of limestones and irons and steels, and of nearly all other substances used in its thousands of manufacturing establishments? We can imagine Dr. Dudley looking westward from his Altoonian laboratory—where "chemical deductions" control, absolutely we may almost say, all the mineral and metal transactions, and many more besides, of the great Pennsylvania Railroad—vainly endeavoring to penetrate the Pittsburg (city of laboratories and chemists) gloom, that in matters chemical enwraps the "Office of American Manufacturer," that he may discover, perhaps for analysis, what manner of man it is that thus coolly scouts and disposes of the "deductions of chemistry," in reference to matters mineral. We turn enquiringly to the well-filled and inviting advertising columns of our cotemporary to see if he admits any chemists to the goodly company there gathered. No "sign" of chemist is there.—Is the faith of our friend so strong in the unreliableness and uselessness of "chemical deduction" that he excludes the men that now, more than any others, control nearly all transactions involving the sale or use of coal and other minerals? Will he "have none of them?" Go to, then; why does he publish chemical analyses, whole columns of them?

This "way of getting out of it" will not do. The "deductions of chemistry," as our cotemporary well knows, decide, generally, without question, what cokes or coals shall go into the great and famous furnaces of Pittsburg or into any one of the great furnaces along the Ohio, and why one kind of coal is fit for and must be used for one purpose and another kind for another.—In fact it would now be a difficult matter to find a large user of or dealer in mineral fuels that does not rely on "the deductions of chemistry" to guide him in his purchases. None of these men rely on "the superior test of practical experience." When the chemist of the state of Pennsylvania says that certain of Connellsville cokes contain .1248 per cent of phosphorus, does he believe, for one moment, that he could induce a single one of the Pittsburg makers of Bessemer pigs or rails to use a single ton of it, no matter what any man might say of his "experience" in its use? It would be an easy matter to specify how "chemical deductions" are relied on for deciding the adaptability and value of coals and cokes for one use and another; but it would be a waste of words to do so. It is settled, beyond enlightened controversy, that an intelligent "practical experience" never finds the properly understood and applied "deductions of chemistry" at fault. We use them as the stronger argument in this controversy, and again commend the contrasted analyses, here published, of Pittsburg and Great Kanawha coals and cokes, and our comments theron, to the care-

ful consideration of every one that would ascertain which is the "superior" article for any or all purposes.

But, not to appear disrespectful to the preference of ways by which the Coal and Coke reporter of *The Manufacturer* reaches his grounds of assumption, let us see how this matter stands the "superior test of practical experience." We will do it by quoting from some of the practical men of the Ohio valley that have used both Pittsburg and Kanawha coals.

Extracts concerning use of Great Kanawha Coals and Cokes.

"Nuttallburg coke compares favorably with other New River coke, and we prefer it to Connellsville coke for our use. It seems to be free from the impurities which in some cokes tend to weaken the iron."—E. Ensign, Treasurer, Ensign Manufacturing Co., of Huntington on the Ohio.

"We have been constant consumers of Nuttallburg coke and coal during the last three years, and feel warranted by experience in saying that this coke is as good a blast-furnace fuel as we have ever used. The coal for blacksmithing purposes is Number one."—Norton Iron Works, of Ashland, Ky.

"Having used Nuttallburg coke for the past two years in our foundry business we cheerfully say we think it equal in all respects to the Connellsville coke, having been able to melt our iron with a proportion of 1 to 9 and 10—melting very fast and hot." —W. C. Daly, Foreman for Ensign Mfg. Co., Huntington, on the Ohio.

"For our purpose—melting steel in crucibles—Nuttallburg coke is equal to any we have ever used, and gives us entire satisfaction." —M. H. Ball, Treasurer Burgess Steel & Iron Works. Portsmouth, Ohio.

The Ohio Falls Car Co., after using Fire Creek coal a year, wrote, in 1878: "With it we can take a heat on a large piece of iron at one point with a small fire, and we can maintain a large *hollow fire* with a small consumption of coal." The agent of the Fire Creek Coal Co. states that this car company has been using this coal constantly since the above statement was made, paying 12 cents per bushel for it, in barge, in lots of 500 and 1,000 tons at a time, when Pittsburg coal was selling at 8 cents per bushel in barge.

The General Manager, (F. DeFuniak,) of the Louisville & Nashville RR. wrote of Fire Creek coal in 1879:—We have been using the Virginia *smithing coal* for about nine months for smithing purposes, both for light and heavy fires. It is an excellent coal for the purpose and gives entire satisfaction."—Sales to this company continue.

The Foreman (F. E. Bush,) of smithing shops of Belfont Iron Works, Ironton, Ohio, writes of Fire Creek coal:—"I think I did with it twice as much work as I did with the same amount of Pittsburg coal. I have used all the coals known in this country, Cumberland, Pittsburg, and others, and never before found a coal so pure and free from sulphur as the Fire Creek coal. I find it equal to the most delicate and most heavy work. I have worked at an anvil 38 years, and think the Fire Creek the best coal for steel used."

A board of Chief-Engineers of the United States Navy, after a prolonged series of tests in the use of New River, W. Va., coal, reported of it that—"It deposited only a small amount of soot upon the heating sufaces of the boiler during an experiment of 48 hours duration;" and "New River bituminous coal is a first-class steam-producing coal and can be advantageously used wherever the best bituminous or semi-bituminous coals can be employed for that purpose."—U. S. Navy Dept. Report on Two Kinds of Coal, 1878.

Statements of "practical experience" in the use of all the New River coals and the cokes made from them—such as are furnished by the Quinnimont, Stone-Cliff, Fire Creek, Elm Caperton, Gaymont, Hawks-Nest and other collieries and ovens —can be furnished, not only from all along the Ohio where they come into successful competition with the Pittsburg coals and their Connellsville cokes,—and where the demand for them exceeds many times the present supply—but from every quarter where they have been tried, all proving what "chemical deductions" unmistakably assert, that they are for many purposes, and for all metallurgical ones especially, not only equal but superior to any other coals now in use in this country.—Whenever and wherever the composition and character of these Lower Measure (No. XII) Virginian coals become known, then and there a constant demand for them will arise.

"Pittsburg coal commands ever and always one cent a bushel more than any other coal in all the markets of the Mississippi valley,"—says *The Manufacturer*. Does it? If he will turn to the Thirty-second Annual Report of the Cincinnati Chamber of Commerce, the one for 1879-80 and the last issued, page 106, he will see that for all the latter part of the fiscal year reported, from March to September, the price of Pittsburg (Youghiogheny) coal afloat was from 8 to 9 cents a bushel,—and that of Great Kanawha coal (Campbell's creek) was *exactly the same* price. During the same time the price of Pittsburg coal delivered was from 10 to 12 cents a bushel,—and the price of Great Kanawha coals delivered was *precisely the same* If he will turn to page 104 of the same report he will see that the average prices for the whole year of these coals in that market were,—Pittsburg afloat 9.06 cents a bushel, delivered 13.22 cents; Great Kanawha afloat 8.66 cents a bushel, delivered 12.55 cents. The differences in favor of Pittsburg for the whole year were .40 of one cent for coals afloat, and .67 of one cent for coals delivered.

In this "superior test of practical experience" what becomes of the assertion that "Pittsburg coal commands *ever and always one cent* a bushel more than any other coal in all the markets of the Mississippi Valley."—We might go further and show from this report that during all that year cannel coal—probably from Great Kanawha mines—commanded from 17 to 20 cents a bushel.

We need not go far to find why, until lately, Pittsburg coals have controlled the Cincinnati market and regulated its prices to their advantage. The following table exhibits the receipts of coal in that city for three years and the percentages of those receipts from Pittsburg and the Great Kanawha.

	Annual receipts.		Proportion.	
Years.	Bushels.	Tons.	Pittsburg.	Kanawha.
1877-78	38,892,229	1,441,754	68.7	17.4
1878-79	34,210,667	1,269,339	60.7	18.9
1879 80	48,198,246	1,787,230	65.8	18.9

This table shows that during three years Pittsburg supplied from 6- to near 7-tenths of all the receipts of coal, consequently it had the capital in coal to trade on, it could take large contracts and fill large orders. Its capital-in-trade gave it control of prices, and, of course, it did control them. The Great Kanawha was next to Pittsburg in its supply, but a long ways behind, not reaching a proportion of 2-tenths. It had but little capital-in-coal to trade on and its powerful rival, as is always the case under such circumstances, dictated the price at which its coals should be sold under the name of "Kanawha," though—it is currently reported—its representatives did not scruple when short of stock to obtain Kanawha coal and sell it to their customers as "Second-pool-Youghigheny," the very cream of Pittsburg's "superior" and "indispensible."

Last year a change began, and for the last five months of that year Kanawha coal was recognized *as in every respect the equal* of Pittsburg, by the "practical test" that it brought the same price. Encouraged by the Improvement of the Great Kanawha by the General Government its miners and shippers added somewhat to their capital-in-trade and a good deal to their capital-in-pluck and claimed that their coal was as good as any that came to that market, as it was, and so demanded and obtained the price of the best for it.

On the first day of next month the Chesapeake & Ohio Railway—that runs for a full hundred miles through the Great Kanawha coal-field—will begin to run its through trains into Cincinnati, and a new and steady factor will enter into the coal trade not only of Cincinnatti but also of Louisville and of places beyond.—(This reminds us that one of our enterprising fellow citizens and coal-men, Mr. Wm. A. Burke, has organized, at 113 Olive Street, St. Louis, Mo., the firm of Burke, Wickham & Co., that hangs out the sign—"Wholesale Dealers in Kanawha Gas, Cannel and Splint Coals and Nuttallburg Coke,") and we are inclined to think that our Pittsburg commentator will hereafter have no further use for the tune of "Ever and always one cent a bushel." For the buyers of coal in the Mississippi Valley will learn to know and appreciate the many varieties of coal from the Great Kanawha fields, that henceforth will "ever and always" be abundant in their markets, not only by the "deductions of chemistry" but also "by the superior test of practical experience."

(CONTINUED ON PAGE 168.)

The Ores and Lower Coal Measures (No. XII) Coals of the Virginias.—Remarks by Prof. Thomas Egleston, of Columbia College School of Mines, New York City.

NOTE.—In the Oct. No. of THE VIRGINIAS, page 153, we gave part of the discussion of Maj. Jed. Hotchkiss' paper on "The Great Flat-Top Coal Field and the New River or Lower Coal Measure Coals," read at the late Harrisburg meeting of the American Institute of Mining Engineers. We now present the remarks made by Dr. Egleston in the discussion of the same paper.—EDITOR.

I am not familiar with all the country which Maj. Jed. Hotchkiss has described, but am perfectly familiar with part of it, having examined it in detail and made a large number of analyses of the coals and iron ores and also of the pig irons produced in the district. From Buffalo Gap to Bluestone river the country is full of iron ores occurring mostly in the Clinton and Oriskany formations, where the deposits are folded in such a way that some of them come to the surface two or three times and are usually in beds 12 to 30 feet in thickness. Occasionally deposits occur in the Trenton limestone and in the Hamilton shales, but for the most part in this section of the country the ores are confined to the Clinton and Oriskany groups.

As the result of over 100 analyses of these ores I find that the sulphur varies from .01 to .37, the manganese from 1. to 8. per cent, the phosphorus from .25 to 1.6, and the iron from 33. to 52., for the limonites. In the red ores of the Clinton formation the iron varies from 31. to 56., the sulphur from .01 to .23, the phosphorus from .13 to .70, and the manganese from .66 to 2.93. The irons are therefore scarcely suitable for the manufacture of Bessemer pig, but they are quite suitable for the modern processes and will undoubtedly make an excellent iron.

As the mean of a large number of analyses of pigs I find the silicon about 2., the sulphur about .8, the manganese 2., and the phosphorus from 1.33 to 1.45. Such material as this makes an excellent foundry iron, which is demanded for many different purposes.

Besides these beds there is in the James River district a series of magnetites extremely low in phosphorus, containing in some instances titanium, but for the most part free from it. The country is intersected by railways in such a way that these ores can be transported to any district where it would be economical to smelt them.

The most remarkable, however, of these deposits are the coals, some analyses of which I will give.

	Lump.	Slack.	Coke.	Furnace. No. 1.	Furnace. No. 2.
Water	0.76	0.83	.....	0.89	1.00
Volatile combus'ble	18.65	17.57	.....	18.49	19.65
Fixed carbon	79.25	79.40	.....	75.02	73.61
Ash	1.11	1.92	5.92	5.09	5.34
Sulphur	0.23	0.28	.....	0.41	0.40
	100.00	.....	.....	100.00	100.00
Ash { Sulphur	0.46	0.55	0.82	3.81	0.80
Ash { Phosphorus	trace	trace	0.13	0.14	0.16

What is remarkable about these coals is the small quantity of ash and their extreme purity. I have never known the ash in any coke that I have examined from this district to go higher than six per cent, and if the coke were made with care the ash could be brought down much lower than that. It is a matter of great surprise to me that this coal has not already competed with the Connellsville coal which on an average contains from 12 to 15 per cent of ash.

I look with great interest on this region of Virginia as in the future to be the centre of a great iron industry when there shall be sufficient transportation to break down the short-sighted policy of some of the great lines of railway in endeavoring to dwarf instead of encouraging local traffic.

The topographical features of these beds, to which Maj. Jed. Hotchkiss has referred, I can testify from personal observation are remarkable, for the whole country is so cut up with the valleys of small streams that the coal may be had not only above water level but water free, by going up the beds of these streams for a certain distance, so that the coal can be mined with the greatest ease and brought to the point of its ultimate transportation by gravity. Generally in these valleys there is sufficient space for the construction of the coke ovens necessary for the manufacture of coke. The experiments in the Longdale furnace, so often cited in the Trans. Am. Inst. Min. Eng. and elsewhere, show that coke can be made of a quality good enough to justify the erection of very large furnaces and that iron can be made at very low prices.

The Tariff on Iron Ores.—Our well-conducted cotemporary, *The Marquette Mining Journal*, the able guardian of the interests of the Lake Superior, Michigan, iron mining districts, is, we are much gratified to see, an outspoken advocate of the imposition of such a duty upon imported iron ores as will protect this highly important and growing American industry against the convict- and pauper-labor dug ores of Africa, Spain and other foreign countries, backed by the miserable policy of our *American* (?) railways, a policy that causes them to carry their imported ores from the seaboard to the interior for from 25 to 30 per cent less toll than they can be induced to move native ores for the same distance from the mines to the furnaces.

In this mining journal for Nov. 12, we find the following items in an editorial urging the iron ore miners of the Lake Superior region to send delegates to the Tariff Convention that is to meet in New York Nov. 29 and 30.—We advise our miners and owners of as yet undeveloped iron mines to consider whether they had not better heed the same advice. Protected, our iron ore mines will become mines of wealth to their owners and to the Virginias. Unprotected, they will be worth nothing.

"This industry is prosperous now, and the miners seem willing to let the future take care of itself; they do not see, or if they do, heed not the gathering cloud of foreign competition which threatens ere long to obscure the sun of their present prosperity. It is true that, figuratively speaking, that cloud is now a mere speck in an otherwise cloudless sky; but it is gathering volume every year, and unless checked by means of healthy legislation, which shall give to the mining industry proportionately equal protection, will ere long engulf that industry in financial ruin. The miners are forewarned; it will be their own fault if they are not forearmed. The tariff law as it now stands on the statute book is a chapter of statutory inequalities and injustice. It will be revised, and the recommendations of this convention will have great weight with the law makers when the question of revision comes before them. For this reason the ore miners, who have vast interests at stake, ought to see to it that they are fully represented in that convention by the ablest men in their ranks."

"The time is coming when, if such precautionary measures as the *Mining Journal* has pointed out are not taken—if equality of protection is not secured to the iron mining industry—the men it is now talking to will get *hurt, badly* HURT financially, and then we shall see them rushing around in search of a remedy for the evil a little timely precaution might have averted."

Lead and Zinc in the United States.—The Engineering & Mining Journal of New York City notices a report,—made by M. Leon Thonard, a distinguished Belgian mining engineer, at the instance and cost of three foreign companies, producers of these metals,—on the lead and zinc industries of the United States, from personal observations made from Sept., 1879, to April, 1880.

M. Thonard visited Virginia and inspected the lead and zinc of the Southwestern part of The Valley; he became a subscriber to THE VIRGINIAS. We hope to procure a copy of his report that we may reproduce what he has to say about Virginia lead and zinc.—The main object of his report appears to have been the question of the probable effect upon European industries of the American productions of lead and zinc. He notices the fact that the American imports of lead have diminished in the past 10 years until they are now insignificant, the U. S. output meeting the demand, which he states as 1,680 tons per million of the inhabitants. He says if the duty on lead were abolished the price would go down, and he had the sense to see that the abolition of this duty would seriously affect these industries in the U. S.

The West Virginia Central Co. has a daily increasing output, and it will add largely to the tonnage from the Cumberland region. To Nov. 9th, the output of the New Central was 243,492 tons.—The Elk Garden coke gave the following analysis: Moisture 0.18, Volatile matter, 1.17, Fixed carbon 89 05, Ash 9.46, Sulphur 0.14. —*Coal Trade Journal.*

Iron Mining.—The shipment of immense quantities of ore from Virginia, by the various mining companies in Virginia, to the great iron States of the North, suggests some important enquiries. The shipment of ore may enrich the present proprietors of mines but will in the end impoverish the State. What we need for the State is furnaces, rolling-mills, and other manufacturers of iron. These take capital, some of them larger capital than our people can raise or can aggregate. Will Northern capital come here sufficient to do this? Not as long as iron manufacturing, smelting, &c., is profitable North and works already operated with imported ores—as long as the ore can profitably be carried from Virginia to Pennsylvania, for instance. "What should our people do? Wait till capital comes? No. Sacrifice their mining properties? No. Go to mining themselves on a small scale. Dig their own ore, ship it and have it sold as they do their corn and tobacco. They will soon be able to sell it at the mines or in Lynchburg. Agents for its purchase and sale will soon be found in this city. We believe they can be found here now, though the competition may not be sufficient at present to make this a good market.

In many places in Virginia men are mining and hauling their own coal to the railroad, and it is found to pay better than a royalty from a company that may suspend any moment.

There is a good market for all the fine ore that goes from Virginia. A thousand tons or so a year would be a paying crop, and the owner of the land would get all the clear profit. —*The Advance*, Lynchburg, Va., Nov. 15, 1881.

Coal Supply for Louisville, Ky.—The business men of Louisville, Ky., recently held a public meeting in the Board of Trade Rooms—as we see by an item from the papers of that city copied by the Coal Trade Journal—to devise means so that Louisville should have a surer supply of coal at all seasons of the year. Mr. Warren Green, a prime mover in this matter, during its discussion, stated that by combinations the Pittsburg dealers had monopolized the market, but now the new lines of railway leading to coal mines were in operation and the time had come for competition. He thought good terms for coal could be secured by offering to take 10,000,000 bushels (When will these western men come down to tons?) annually from one line of railway. Mr. Green gave Kanawha "a send off," says the report of the meeting, and stated that he "understood that some large manufacturers in Cincinnati preferred Kanawha to Pittsburg coal, even at higher rates, and there is no doubt of its being a good article. Another thing it does not require as high a river to transport it as the Pittsburg, etc."

We have been waiting for some time for the movement for deliverance from the "up river" coal monopoly to begin in the "down-the-river" cities, the cry about a "superior" and "indespensible" article has been so loud. Louisville is the first to move for "fair trade" and better fuel. We salute her. She shall have both.

Phophorus in Coals and Cokes.—In Report MM. of the Pa. 2nd Geological Survey, page 126, it is stated that phosphorus is present in most objectionable quantity in many of the Pa. coals and cokes entirely unfitting them for use in the manufacture of pig iron intended for conversion into steel by the Bessemer or open hearth rocess. "Several of the specimens examined from the Pittsburg coal beds—from which our supply of coal for coking purposes is so largely drawn—contain a most damaging amount. The percentage varies from a mere trace to 0.1248 per cent, the average of the 24 coals from this bed, being 0.0217, equal to 0.0344 in the coke."

We have, so far, had but few determinations of phosphorus in our Kanawha coals. In Nuttallburg coal Prof Thos. Egleston found 0.084; in Fire Creek coke, made from "slack" coal, it was found to be 0.008 by A. S. McCreath.—It would seem from the last analysis, which we doubt not would be that of most of the Lower Measure (No. XII) coals, that in this particular we have Kanawha coals at least *equal* to the Pittsburg.

Coal Market Prospects.—The *Coal Trade Journal* of New York of Nov. 16, says: "Bituminous coal steady, and the better grades in short supply; there are orders on hand for a large percentage of the regular weekly production, and there is no accumulation to force prices. The operators are looking forward to next season being more profitable than the present has been. It will be apparent to any one who examines the statistics that there is an increasing consumption of this fuel in every manufacturing town in the seaboard states. It will be noticed that the Chesapeake & Ohio road is now completed to deep water at Newport News; there will be a larger shipment of the coals from the Kanawha region next season, as there are many developments under way, and this point of shipment is superior in every respect to Richmond."

Connellsville vs. West Virginia Coal.

The *Keystone Courier*, of Connellsville, Pa., kindly copies as follows from our October number, and concludes with a brief but pithy comment:

"The Staunton Virginias learns from a reliable source that H. C. Frick, with one or more associates, has purchased, after a careful and thorough exploration, the Loup Creek tract of coal land, about 35,000 acres, in Fayette county, West Virginia. The Virginias thinks it surprising that bituminous coal lands in Pennsylvania, containing but two or three beds of workable coal, and remote from transportation and from market, should sell for hundreds of dollars per acre, when lands with four times as much workable coal, equally good in quality and greater in variety, all lying above water level, on and near the Great Kanawha, an important navigable river, where one line of trunk railway is completed and another is in progress, and two hundred miles nearer western markets, can be bought at from twenty-five to fifty dollars per acre. There can be but one explanation. Either capital is blind or the Connellsville coal has superior qualities. We are inclined to think it is the latter, no offence to our cotemporary."

We not only take no offence but are much obliged to our cotemporary for giving publicity, in the great and industriously developed coal region it so ably represents, to our statements of facts and then giving us an alternative conclusion. It must pardon us for accepting its first reason as to why the Kanawha coal lands are not bought in preference to the Connellsville.—*Capital is blind* until such men as Frick of Pittsburg, Ward of Detroit, Huntington and Low of New York, the Wrights and Steele of Philadelphia, Williams of Baltimore, and other such men of foresight and means by their doings open its eyes, fixed on present gains, to the certainties of larger profits that may be had in the near future by entering into the possession, at nominal prices, of the solid wealth of the richest bituminous coal field on this continent. The few lead, the multitude will follow,—in fact its advance guard is now taking possession of numerous points of vantage in the Great Kanawha coal-field.

In our school-boy days we were much struck by the reason that Sallust gave for becoming a historian; he had become wearied with the obtrusively and industriously made-known glories and greatness of the Greeks to the disparagement of the Romans,—glories and greatness known and magnified in his opinion, because the Greeks had many writers to make them known while his people had but few such molders of public opinion.—We are inclined to think that our Western Pennsylvania coal-producing neighbors have hitherto had the Grecian advantage over us in this coal matter. In all friendliness and truthfulness we have been doing and propose to continue to do what we can to bring up our end of the line.

Chesapeake & Ohio Railway.—This road is now completed to Newport-News, on Hampton Roads, but is not yet opened for regular traffic, but it probably will be some time in December. *The Coal Trade Journal* of Nov. 9, states, on the authority of Vice-President A. S. Hatch, that negotiations are pending with the White Star Steamship Co. in reference to the establishment of a line of steamships between Newport-News and Europe; also that the C. & O. Co. has already contructed two piers, one for freight and one for coal, and is preparing to erect a grain elevator with a capacity for 1,200,000 bushels. The Virginia Land Co., which is composed of parties interested in the C. & O., is erecting two hotels and has laid out the city of Newport-News. It is expected, and with good reason, that large quantities of cotton and tobacco, as well as grain, the climate being well adapted for storage, *being equable*, and the harbor *a fine one*, will come to this point.

The Iron Ore Shipments of six of the principal mines on Lake Superior for this year, up to Nov. 10, have been 1,018,797 tons, the market value of which will be about $10,000,000. The shipments of iron ore from all the Lake Superior mines this year to Nov. 10, were 2,110,319 tons,—an increase of 303,277 tons.—*Marquette Mining Journal.*

The above statement will give our readers some idea of the present consumption of iron ore, and of the wealth that is derived from the mining and sale of this raw material,—for most of the ore mined on Lake Superior is sent to the eastward markets.

Pittsburg vs. Great Kanawha Coals.

(Continued from page 165.)

Reserving further comments on the "assumptions" of *The American Manufacturer* for our next issue, we will now continue from page 149 of our Oct. number.

As one or two typographical errors crept into the tables of analyses published in our previous article, we here republish those tables, changing their form so that the elements of the coals and cokes appear in columns, and adding one or two more analyses.

I. Pittsburg Coals and Cokes.

1. *Analyses of Pittsburg bed coals.*

No.	Fixed Carbon.	Sulphur.	Ash.	Volatile matter.	Water.	Coke per cent.
1.	59.616	0.784	8.233	30.107	1.260	68.633
2.	64.750	1.380	6.310	26.060	1.500	. . .
3.	55.901	1.931	11.556	29.662	0.950	69.388
4.	54.383	0.792	5.440	38.105	1.280	60.615
5.	54.598	0.638	5.357	37.980	1.427	60.593
6.	57.200	0.710	3.612	36.873	1.517	61.000
7.	50.230	3.040	9.030	36.900	0.800	62.300

No. 1. Lump coal from Broad-Ford mine of Frick & Co., analyzed by A. S. McCreath, chemist of Pa. Geol. Survey.—The "ash in coke made from this coal was 11.995 per cent.—Report L. of Pa. Geol. Survey, page 63, says: "This may be taken as a fair sample of the Connellsville coking coal," and J. G. Fulton, E. M., the General Mining Engineer of Cambria Iron Co., in Report on Coking Coal, G. of the Pa. Geol. Survey, page 242, takes this as the "typical" Connellsville coal, the one that makes the best coke.

No. 2. This is the "average standard," the average of the analyses of several of the "best typical coking coals" of Pennsylvania, and is the "standard" of Mr. Fulton's report, (G., page 242). Mr. Fulton states that "Any excess of volatile matter over 25 per cent is not a necessity."

No. 3. "Connellsville *slack* coal" from Broad-Ford mines of Frick & Co.; analyzed by A. S. McCreath, Report MM., page 22.

No. 4. Coal from mine of Penn Gas Coal Co., Westmoreland county; analyzed by A. S. McCreath. Report MM., page 123.

No. 5. This an average of the analyses of three samples of coal from mines of Penn Gas Coal Co., by A. S. McCreath.—Report KK., page 60; and in the same connection the remark is made that this "Is the typical gas coal of the country," and on page 382 that "The Penn gas coal is the standard."

No. 6. This is an average of the analyses of three samples of coal from the mines of the Westmoreland Coal Co., by A. S. McCreath. On page 333, of Report KK., it is stated "In the works belonging to both these companies (the "Penn" and the "Westmoreland") the coal is of exceedingly good quality, and is mined for shipment to be used almost exclusively in the manufacture of illuminating gas," and on page 382 "The analyses show that the *Pittsburg bed*, as found in the Greene and Washington district, yields a remarkably fine gas coal, the average of 14 analyses giving 37,964 per cent of volatile matter."

No. 7. Analysis, by A. S. McCreath (Report M³ page 56), of coal from Ewing's mine in "Pittsburg bed," Armstrong county.

2. *Analyses of cokes made from Pittsburg coals.*

No.	Carbon.	Sulphur.	Ash.	Water.	Volatile Water
1.	89.147	0.084	9.523	0.032	1.296
2.	87.259	0.746	11.995	. .	. .
3.	89.576	0.821	9.113	0.030	0.460
4.	88.906	0.771	9.931	0.040	0.352

No. 1. A typical, verified analysis of Connellsville coke, made from very pure coal; by E. C. Pechin. Pa. Geol. Survey Coke Report of 1875, L., page 16.

No. 2. Coke from Broad Ford mine coal of Frick & Co., by A. S. McCreath. L., page 63.

No. 3. Analysis of average samples of a large quantity of well made coke from the Broad Ford ovens of Frick & Co.; by A. S. McCreath. The water was at 225°. Report L., page 78. In Report L., page 81, this is called "The typical good coke."

No. 4. Analysis of Connellsville coke, used at Grafton Ironworks, Letonia, Ohio; supplied from ovens of J. F. Dravo.—(Report M² ., page 107).

II. Great Kanawha Coals and Cokes.

3. *Analyses of Coals from New River or Lower (No. XII) Measures.*

No.	Fixed Carbon.	Sulphur.	Ash.	Volatile Matter.	Water	Coke per cent.
1.	77.675	. . .	0.895	20.175	1.255	78.570
2.	70.883	0.669	2.033	26.130	0.954	72.916
3.	79.25	0.46	1.11	18.65	0.76	. . .
4.	75.499	0.536	0.805	22.425	0.735	76.84
5.	71.82	0.371	1.34	34.43	2.41	. . .
6.	70.664	0.536	2.10	25.35	1.35	. . .
7.	75.37	0.26	1.87	21.83	0.93	. . .
8.	79.40	0.55	1.92	17.57	0.83	. . .

No. 1. Coal from 12 ft. "Nelson bed" of Great Flat-Top Mountain or Bluestone River (of New River) Coal-field, Mercer Co., W. Va., and Tazewell Co., Va. Sample from whole 10 ft. of thickness of clean coal in upper stratum of bed. Analyzed, July, 1881, by Booth, Garrett & Blair.—Mine then driven but a few feet.

No. 2. Coal from "Crockett" bed of Great Flat-Top Mountain Coal-field; analyzed, August, 1881, by Booth, Garrett & Blair. Sampled before mine was fairly opened to under cover; so result is not a fair one.

No. 3. Lump Coal from Quinnimont colliery, Chesapeake & Ohio Ry.; analyzed by Prof. Thomas Egleston, of Columbia College, N. Y., School of Mines, August, 1879.—An analysis of "slack" from same mine, made at same time, gave very nearly the same results.

No. 4. Analysis of Lump Coal from Fire Creek colliery, Chesapeake & Ohio Ry., by A. S. McCreath, analyst of Pa. Geol. Survey, July, 1881.—McCreath says of this: "It represents a coal of remarkable purity, and it should yield a coke with a little more than one per cent of ash and about one-half of one per cent of sulphur.

No. 5. Analysis of a large number of samples from stock pile at Low Moor furnace of run-of-the-mine Coal from Elm colliery of Beury, Cooper & Co., on Chesapeake & Ohio Ry., by J. Blodget Britton, Oct., 1881.—This coal when sampled had been transported 118 miles from the mine to Low Moor furnace, where it is coked at the furnace for use in it. The "water" result would have been different, no doubt, if the samples had been taken at the mine.

No. 6. Analysis of sample representing whole thickness of coal bed at Nuttallburg colliery, Chesapeake & Ohio Ry., by Prof. Thomas Egleston.

No. 7. Analysis of coal from "Echols" mine, Hawks-Nest station, C. & O. Ry., by Prof. J. W. Mallet, of University of Virginia.

No. 8. Of slack coal, from. Quinnimont, by Prof. Thomas Egleston, August, 1879.

4. *Analyses of Cokes made from New River No. XII Coals:*

No.	Carbon.	Sulphur.	Ash.	Water.	Volatile matter.
1.	94.03	0.494	3.90	1.49	0.58
2.	91.94	0.538	6.92	0.102	0.492
3.	92.18	0.618	6.68	0.110	0.350
4.	91.22	0.92	7.53	. . .	. . .

No. 1. Analysis of Coke made at Low Moor Furnace coke ovens from Elm colliery coals (Beury, Cooper & Co.), Oct., 1881, by J. Blodget Britton.—The analyst stated that the moisture shown was absorbed from the air after coking; he also pronounced this as "Undoubtedly a superior coke." We may add that at the time of the sampling for the analysis coking operations had not fairly begun at Low Moor, and that the analyst considered the coke by no means as good as could be

made from the coal used—that of No. 5 of preceding analyses of New River coals.

No. 2. Analysis of coke made from "Slack" coal of Fire Creek colliery, July, 1881, by A. S. McCreath.—The unusual "ash" percentage can be easily accounted for, since all the slate clippings and other impurities of the mine went into the slack. This colliery can furnish coke, as McCreath says, (See preceding analysis No. 4) with about 1.5 per cent of ash.

No. 3. Analysis of Fire Creek coke by J. B. Britton.

No. 4. Partial analysis of sample of coke from Nuttallburg colliery, by Prof. C. E. Dwight of Wheeling, W. Va.—The sample could not have been a fair one, for Prof. Egleston's analysis of the coal of this colliery (No. 6 of preceding analyses) shows that coke from it should contain only about 3 per cent of ash.

5. *Analyses of Coals from Great Kanawha or Middle (No. XIII) Measures.*

No.	Fixed Carbon.	Sulphur.	Ash.	Volatile Matter.	Water.	Coke per cent.
1	72.32	0.27	5.27	21.38	1.03	77.59
2.	83.31	0.74	2.15	12.40 (?)	1.40	. .
3.	57.20	. .	4.30	38.32	0.18	. .
4.	62.61	0.18	1.81	33.26	2.14	. .
5.	58.04	0.72	3.80	38.16	. .	. .
6.	61.60	0.64	1.87	35.20	1.32	. .
7.	61.07	. .	1.21	35.64	1.88	. .
8.	56.50	. .	1.50	40.50	2.00	. .
9.	43.20	. .	10.20	46.50	. .	. .
10.	68.53	. .	3.22	27.01	1.24	. .

No. 1. Analysis of Sewell, Fayette county, W. Va., coal, that from which coke is made for the Longdale furnaces.—This is from what is most probably the lowest workable bed of the Middle (No. XIII) measures, of the Great Kanawha. Engineer Page (THE VIRGINIAS Vol. I, page 22) places it 45 feet above the top ledge of the Great Conglomerate. Dr. Chance (THE VIRGINIAS, Vol. II, page 153) thinks this bed may correspond to the Bennington (Kittanning Lower) coal of Western Penn.

No. 2. Analysis by Dr. Percy of Royal School of Mines, London, Eng., of samples from the 11-feet bed of Gauley Mountain colliery of Hawks-Nest Coal Co. The coal that will be used for coke by the Virginia Iron & Steel Association.—The analysis of Dr. Percy as we gave it in our last number was misleading. He gave it, in his letter of Aug. 4, 1874, in these per cents: Carbon 83.31, Hydrogen 5.54, Oxygen and Nitrogen 6.86, Sulphur 0.74, Ash 2.15 and Water 1.40,=100, and the "percentage results obtained on carbonizing" as: Coke 65.99, Volatile matters 32.61, and Water 1.40. This coal analysis by Dr. Percy gives its "ultimate composition," and so it is not in form for comparison with the other analyses. In Dr Wormley's chemical report (Ohio Geol. Survey, 1870, page 425) we find the "ultimate composition" of Youghiogheny coal (from Columbus Gas-works) as follows: Carbon 81.27, Hydrogen 5.66, Nitrogen 1.66, Sulphur 0.98, Oxygen 7.08 and ash 3.35.

No. 3. Analysis by Prof. C. E. Dwight, of Wheeling, W. Va., of coal from upper portion of bed mined by Coal Valley Coal Co., near Cannelton, W. Va.

No. 4. Analysis of "Coalburg" upper coal, Coalburg, Kanawha county, W. Va., by Dr. Doremus.

No. 5. Prof. S. P. Sharples' analysis of Davis Creek 10-feet bed coal.—See Prof. Shaler's statement concerning this coal, THE VIRGINIAS, Vol. II, page 154.

No. 6. Analysis of coal from the lower (5′ 8″) part of Coal Valley Coal Co's bed.

No. 7. Campbell's Creek, Kanawha county, coal; analysis by chemist of Riverside Iron Co.

No. 8. Coalburg "main seam;" analyzed by Levette of Indiana.

No. 9. Cannelton, Fayette county, W. Va., selected cannel coal, by Charles M. Cresson.

No. 10. Analysis by Prof. Locke of Cincinnati, of coal from Winifrede mine, Kanawha county.

6. *Analyses of Cokes made from Great Kanawha, (No. XIII) Coals.*

No.	Carbon.	Sulphur	Ash.	Water.	Volatile matter.
1.	90.31	0.594	7.92	1.08	0.69
2.	93.00	0.27	6.73	. .	. .

No. 1. Analysis of coke made from the 6-feet Coal Valley seam coal, mined at Crescent coal mine, Fayette county, W. Va., by Prof. J. W. Mallet of University of Virginia.

No. 2. Analysis of coke made from coal of Sewell bed, probably by J. B. Britton.

We have at hand but few analyses of Middle measure coals or cokes, for, excepting the Sewell mine, no coking of these coals has been done but on a small scale at Hawks-Nest and at Eagle collieries, now they are increasing the plant at both these places, especially at the latter, and analyses will soon be forthcoming.

The preceding analyses show:

1. In reference to *carbon percentages in coal*, that the Pittsburg coals range from 54.383 to 64.750, while those of the Lower Great Kanawha range from 43.20 to 83.31, or more fairly, (omitting cannel coal, No. 9, and the "ultimate" composition of No. 2), from 56.50 to 72.32; and those of New River, the Upper Kanawha, from 70.664 to 79.40,—the Great Kanawha Middle Measure coals (omitting cannel) averaging better in carbon than the Pittsburg, and the Great Kanawha Lower Measure, or New River surpassing the best Pittsburg from 5.914 to 14.650 per cent, and the worst from 10.434 to 29.170 per cent; and in each case to the extent of those less carbon percentages that much less efficient in calorific power, and to the same extent that much less valuable as heat-fuels.

2. In reference to *carbon percentages in cokes*, that the Connellsville cokes range from 87.259 to 89.576 per cent, while those from Lower Kanawha (the few that we have) range from 90.31 to 93.00, and those from Upper Kanawha (New River) coals from 91.22 to 94.03 per cent,—all of the Great Kanawha cokes surpassing the best of the Connellsville from 0.724 to 4.454 per cent in carbon, and therefore in calorific efficiency. The tests of work done by these cokes, in blast furnaces and elsewhere, fully sustain the claims made by these chemical deductions.

3. In reference to *sulphur percentages in coals*, that the Pittsburg coals range from 0.638 to 3.040, the Great Kanawha No. XIII ones from 0.18 to 0.74, and the New River No. XII ones from 0.26 to 0.669. These results indicate by the "deduction of chemistry," that the Great Kanawha coals have much less of this iron- and steel-damaging and gas-deteriorating element in them than the Pittsburg, and the extract from the letter af the President of Cincinnati Gas-light Co., and that from the Treasurer of Ensign Manufacturing Co., published elsewhere, show "by the superior test of practical experince" the same conclusions.

4. In reference to *sulphur percentages in cokes*, that they range, in Connellsville (Pittsburg) from 0.084 to 0.821, in New River from 0.494 to 0.92, and in Kanawha proper from 0.27 to 0.594; apparently to the general advantage of Connellsville, but not if No. 1 is excluded from the Pittsburg list, as it should be, as that was not a commercial article, as Pa. Report L., page 16, shows—We selected the best Pittsburg analyses we could find out of a large number published in the Pa. Reports. We have as yet had but few analyses made, and so present what we have,

5. In *ash percentages in coals*, the Pittsburg coals range from 3.612 to 11.556, the Great Kanawha from 1.21 to 10.20, and the New River from 0.805 to 2.10. In this particular the Great Kanawha coals have very greatly the advantage, especially the New River ones, making them much more valuable as fuels, because less *useless matter* has to be transported and handled, less slag has to be fluxed away in blast-furnace work, an operation that requires heat units to effect, etc.

6. In *coke ash per-cents* the Connellsville cokes range from 9.113 to 11.995, the Kanawha from 6.73 to 7.92, and the New River from 3.90 to 7.53; results which need no comment. The very remarkable results from the use of New River cokes in blast-furnaces come, in part, from their low percentage of ash.

(To be continued.)

Analyses of Campbell and Appomattox Counties, Va., Iron and Manganese Ores and Limestones.

By J. Blodget Britton.

During the spring and summer of this year, 1881, Mr. J. Blodget Britton, the well known analyst of the "Iron-Masters' Laboratory" of Philadelphia, Pa., at the instance of Messrs A. D. Robertson & Co., of Lynchburg, Va., visited the belt of country extending from Otter river and the Virginia Midland RR., northeast, across Campbell county and the Norfolk & Western RR. on the easterly border of that county, into Appomattox county far enough to include Mt. Athos and Chestnut mountain on James river—the whole region visited being some 25 miles of the length of what has become known as the "James River Iron Belt,"—and personally sampled the iron and manganese ores and limestones there found for the purpose of analyzing them. The results of that visit are before us, in a 13 page pamphlet, (dated August 22d, 1881) and as they cover a portion of this belt—(one that should be called the "Piedmont-Midland Iron Ore Belt," as it runs through Virginia between its Piedmont and Midland divisions, including a portion of each), the part across Campbell county, that we have not before given any facts concerning, we will give the substance of this interesting, very valuable and somewhat exhaustive report.

The iron ores were sampled so as to represent fairly an average of the exposed masses and the associated gangue; the manganese ones to represent the average character of the ore after being washed and prepared for market; and the limestones from projecting weather outcrops (and therefore not fair samples), as no quarries in it had been opened.

The following extracts from Mr. Britton's report furnish some of his general results and conclusions :—

"Judging from the results of the analyses of the iron ores, it would seem that they had one common origin; their constituents appear to be identical, a variation in the relative proportion of these constituting the chief difference between them.—The searches for sulphur and titanic acid revealed nothing beyond very doubtful traces. Phosphoric acid was found to be constantly present, and was the only decidedly objectionable impurity detected; special searches showed it to be mainly in combination with the iron, very little being in the gangue."

"Fragments of manganese ore were discovered at nearly all of the openings, but the occurrence of these I judged to be pretty generally outside of the iron ore or in pockets, and capable of being separated in mining. Manganese is a common constituent of hematites, and is not objectionable in ores intended for blast-furnace use unless it is excess and soft gray foundry metal is wanted. It acts partly as a flux and causes the furnace to work faster. Its effect, when too much is present, is to purge or scour, cutting the inwalls more or less, and generally to make the pig metal white and hard; with a larger quantity the metal is crystalline."

"Magnetic oxide was found to be uniformly present, but in quantity very small, except as to sample No. 1, which contained 8.75 with 46.10 of sesquioxide; this sample came from the south-western slope of Mount Athos. Soda and potash were not searched for; these substances were present doubtless, and most in the samples bearing the most gangue. Their presence in an iron ore is of no consequence unless the quantity be unusually large; they act as a flux more energetically than lime, and are never hurtful."

"The average amount of metallic iron found by the analyses is above the average yield of the brown hematites of the country. But it is not unreasonable to expect that these ores will give a higher per cent of iron than has been found by the analyses, when their main bodies are entered upon and the mining is done so as to reject all unincorporated gangue."

"It was not possible to form any trustworthy estimate of the probable quantity of ore fit for furnace use that could be mined at any of the points visited, the developments were quite insufficient for the purpose. At several some considerable mining had been done, and partial exposures of the ore in body were made, and at these the evidences were plain that further work would reveal the ore in larger quantity, and in some instances greater density. At the other points mostly only shallow cross cuts, three or four feet wide, had been dug, deep enough, however, to afford very conclusive indications of the existence of very considerable bodies beneath. Wherever the ore was exposed, it followed the lead of the general stratification, bounded by walls on the northwest and southeast, and was apparently vein-formed."

"At these exposed points the width on top was in most cases carefully measured with tape-line, the length could not be, though the "float" in the surface was generally traceable for some distance, varying from a few rods to a mile or more.—The general stratification being nearly vertical, the ore may be presumed to exist to great depth. The object of my visits was to ascertain to what extent openings had been made upon the mineral in the field mentioned, and to obtain therefrom proper samples for analysis."

The report presents twenty-nine analyses of iron ores, most of them full ones; two of manganese ores; and eight of limestones; all but a few from recent openings and from points in the range of, but beyond the field explored from samples collected by himself.

By reducing the results we find that in the 26 samples selected by Mr. Britton, the "*pure metallic iron*" ranged all the way from 24.02 to 58.29 per cent, averaging for the 26 samples 43.77 per cent; the *silica* ranged from 4.71 to 55.89, averaging 23.92 per cent. The *water* in 23 samples ranged from 1.22 to 11.81 per cent, averaging 8.68; the *alumina* ranged from 0.67 to 5.76 per cent, averaging 3.79. The lime in 11 samples ranged from 0.06 to 0.36, averaging 0.16 per cent; in 12 samples there was only "a trace" of lime. The *magnesia* in 11 samples ranged from 0.03 to 5.02 per cent, averaging 0.79, while in 15 samples only "a trace" was found. The *oxide of manganese* in 11 samples ranged from 0.16 to 2.97, averaging 1.04 per cent; in 9 samples only "a trace" was found. The *phosphorus* in 26 samples ranged from 0.084 to 1.372 per cent, averaging 0.607. In one sample "determinable traces" of sulphur and titanic acid were found; no other mention is made of these substances.

From the 26 analyses of samples of iron ores collected by Mr. Britton we have selected the following ten as representing the mines that Mr. Britton's notes appear to indicate as having, from the prospecting that had been done at that time, the most commercial value. They do not include the one that had the most pure metallic iron (58.29) as the character of the opening did not reveal whether there was a large body of ore there. The numbers of the analyses are those of the samples of the report.

	No. 1.	No. 3.	No. 5.	No. 6.	No. 13.	No. 14.	No. 16.	No. 17.	No. 19.	No. 22.
Pure met. iron,	39.03	34.63	55.95	46.24	48.04	43.41	46.82	37.56	49 02	50.97
Oxygen with iron,	15.82	14.73	23.79	17.14	20.50	18.52	19.93	15.97	20.93	21.72
Silica,	38.93	31.31	7.08	25.80	15.17	19.96	9.39	36.69	16.05	11.46
Water,	1.22	9.21	10.28	9.53	9.87	9.62	11.98	3.68	9.35	11.81
Alumina,	3.98	5.36	1.03	3.69	4.88	5.26	3.93	4.98	3.01	2.00
Lime,	.26	.23	trace	trace	.06	trace	.09	trace	trace	.11
Magnesia,	.17	.16	trace	.....	trace	trace	5.02	trace	trace	trace
Ox. of manganese,	.37	2.97	.32	1.30	trace	1.62	1.55	.14	trace	trace
Phosphoric acid,	.192	1.124	1.406	2.045	1.243	1.152	.984	.692	1.559	2.49
Undeterm'd & loss,	.028	.276	.144	.255	.237	.158	.306	.288	.081	.53
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100 000
Phosphorus,	.084	.491	.614	.893	.543	.503	.43	.302	.681	1.048

"Notes.—1. Called Mill-dam opening, on S. W. slope of Mount Athos. A drift had been driven to the N. E. extending horizontally about 180 feet, and from a point about 45 feet above the bed of Archer's creek, and distant some 200 yards north of the Norfolk & Western RR. The ore-bearing stratum varied in width from 6 to 8 feet, and was nearly vertical, dipping a little towards the S. E. In the lead of this stratum or a half mile or more to the S. W., considerable "float" ore rich in iron was found, the space between being low ground. The ore mined from the drift, or the greater part of it, was still on the ground; in character it was a silicious magnetic and red oxide inconstantly mixed. The sample taken consisted of numerous fragments and fine stuff, and weighed 1 lb. 12½ oz.—Color when pulverized, a light reddish gray.

3. Opening on north side of RR. and a short distance east of No. 2, was a vertical open cut extending north-eastwardly about 100 feet, showing an ore-bearing breast averaging 27 feet wide. About 500 tons had recently been mined and shipped from this point. A small pile waited shipment. The sample for analysis was taken from all across the breast of the cut, and consisted of numerous fragments with a due proportion of the gangue; weight 1 lb. 7½ oz, ore, a variable silicious brown hematite. Color of powder light grayish brown.

5. Small opening in body of ore on side of public road.—Width of vein 6 feet, with indications of greatly increased width beneath. A few hundred yards to the north-east is an open field the same vein was again struck by a cross-cut 2 to 4 feet deep, and a width of fully 25 feet is shown. A sample consisting of 4 pieces, (weighing 13¼ oz.) having been taken from the road side opening, another from the second opening was thought unnecessary; ore, a compact brown hematite. Color of powder normal brown.

6. A narrow cross cut 2 or 3 feet deep, on top of hill, reveals a vein 34 feet wide; a portion of the mineral quite dense.—Sample consisted of 18 pieces, and associated gangue; ore, a brown hematite. Color of powder chocolate brown.

13. Known as Olney's working. A shaft, said to be eighty feet deep, was sunk here 4 or 5 years ago, to supply the Powhatan Furnace. The quantity of ore taken not ascertained, but probably some hundreds of tons. A working breast of 7 feet at bottom of shaft was reported. All of the ore mined had been shipped except some little left scattered on the ground. A surface opening near by showed a width of ore varying between 15 and 20 feet. This latter was apparently on an independent parallel vein of considerable magnitude.—The location was on very elevated timbered ground. Sample for analysis was taken from both product of shaft and surface opening, and consisted of 33 pieces and fine material; weight 1 lb. 14 oz; ore, a brown hematite similar to the last mentioned.

14. This was an old open cut working, starting horizontally both ways on the lead from a depression or wash which cut the stratification at right angles. There was much caving in, but the average width of breast, I judged to be about 11 feet. On the N. E. extension a depth of 30 or 40 feet had been reached, the depth increasing as the hill was cut into. Hundreds of tons of ore had evidently been mined and carried away.—The vein exposed here may not be a separate one; seemingly it was a continuation of the last mentioned, "float" being found mostly all the way between the two points, distant from each other more than a mile. Sample consists of 23 small pieces and fine stuff taken from both cuts; weighed 2 lbs. 5½ oz.; ore, a brown hematite. Color of powder a chocolate brown.

16. A shallow cross-cut reveals the ore near the surface 10 feet wide. The point is at the foot of a hill and a few feet above the level of a branch some 50 yards to the S. E. Sample consists of 13 pieces and fine material, and weighed 1 lb. 5 oz.; ore, a fine compact brown hematite. Color of powder chocolate brown.

17. On the top of hill about a quarter of a mile west from last mentioned point, a shallow cross-cut partly revealed the ore. The ore-bearing stratum was apparently 6 feet wide, but the earth was caved in and a close measurement could not be made. I was informed that a width of 10 feet was indicated when the cut was first made. This was claimed to be on the lead from Mount Athos 8 or 9 miles distant to the N. E. Sample consisted of 10 pieces and fine stuff, and weighed 1 lb. 9¾ oz.; ore, a silicious stratified red oxide mixed with a little brown. Color of powder brownish red.

19. A shallow cross-cut opening reveals a fine body of ore 20 feet wide. Out-crop and abundant "float" on line of lead both ways for some distance. Sample consisted of 12 pieces and fine stuff, and weighed 1 lb. 12 oz; ore, a compact brown hematite. Color of powder normal brown.

22. A shallow cross cut on out-crop of vein reveals an apparent width of 18 feet; on timbered land; out-crop shows well. Sample consisted of 14 pieces and fine stuff, and weighed 2 lbs. 3 oz; ore, a brown hematite. Color of powder normal brown."

The following analyses of *Manganese ore* are given.

	No. 30	No. 31.
Manganese binoxide,	76.40	88.30
Silica	10.96	5.54
Iron peroxide	9.30	.47
Residue and loss	3.34	5.69
	100.00	100.00

"NOTES.—30. Mine some three or four hundred yards south of the Norfolk & Western RR. A drift running southwestwardly has been started well up on the side of the hill, and a penetration of some 300 feet had been reached. The average width of the ore-bearing stratum, the superintendent informed me, was about 4 feet. Work was going on at the time of my visit. The preparation for market was by hand-picking and washing with rocker and jig. About three hundred tons, I was told, had been prepared and shipped. The sample for analysis was taken from the platform at the railroad, where a little of the prepared ore had been left; consisted of 20 small pieces, and weighed 1 lb. 1¾ oz. The mineral appeared to be chiefly pyrolusite.

31. A drift had been started at the base of a hill and carried southwardly about 250 feet. The ore-bearing stratum varied in width from 6 to 15 feet or thereabouts. Considerable mineral had been taken out, but not any prepared for market. The sample for analysis was taken from a pile of picked lumps, and considered as fairly representing an average of what the carefully prepared product of the mine would be; consisted of 9 pieces, and weighed 2 lbs. 2½ oz. The mineral was a pyrolusite with a little manganite.

The *Limestones* that were sampled and analyzed by Mr. Britton gave the following results:

	No. 32.	No. 33.	No. 34.	No. 35.	No. 36.
Lime carbonate,	77.67	67.85	82.45	65.10	91.51
Magnesia carbonate	3.78	6.02	2.10	2.96	2.59
Silica	15.88	20.42	10.98	26.90	....
Alumina,	.97	1.20	.70	.86	....
Water,	.27	.41	.16	.21	.41
Iron protocarbonate	1.16 }	3.80	2.90	3.94	....
Iron peroxide,	.... }				
Iron pyrites,	....	.22	.19	....	....
Phosphoric acid,	.003	.006	trace	.004	....
Manganese oxide,	.07	trace	trace	trace	....
Iron and Manganese oxides and Alumina,	....	....	....	....	2.77
Insoluble silicious matter,	....	....	....	....	2.56
Undetermined and loss,	.197	.074	0.52	.026	.16
	100.000	100.000	100.00	100.000	100.00

"NOTES.—32. A nearly vertical stratum about 3 feet wide, on the north side of the N. & W. RR. Supposed to be an out-crop of a stratum 40 feet wide, exposed in the bed of a branch to the south of the railroad. Distance from location or point 3 eastward about 100 feet. Sample consisted of 12 fragments weighing 4½ oz., chipped from weathered edges. Mineral a blue limestone.

33. The seam or stratum here is about 25 feet wide, and is crossed by a public road and a small branch; distant about 300 yards from the railroad bridge, 7 miles from Lynchburg. The stone had the appearance of being inconstant in composition across the line of stratification. Sample consisted of 3 fragments, and weighed 1½ oz. Color of stone very light blue.

34. Same stone, only another sample of dark blue color; consisted of two fragments, and weighed 2⅞ oz.

35. A stratum of blue limestone, about 50 feet wide, exposed in the branch a little south of the railroad. The sample was chipped from various projecting edges, all weathered; consisted of 16 pieces, and weighed 7 oz.

36. A stratum about 40 feet wide shows itself in the bed of a branch. No quarry open. The stone is crystalline in structure, nearly white, with some blue. Locally known as the white limestone. Sample consisted of 10 fragments chipped from weathered projections. Some pieces of fine calc-spar were in the sample. Weighed 12¼ oz.

We may add that Mr. Drewry G. Ottley, a skillful engineer of Lynchburg, Va., carefully surveyed the ore belt from which Mr. Britton selected his samples, and mapped the out-crop lines of its iron and manganese ore-bearing and limestone strata, making an important contribution to our geological information concerning this interesting and valuable region,—one that we hope the Messrs Robertson will publish.

Three of our great railways, each leading directly to tidal ports themselves and by connections to all the important markets of the country, cross or run along the ore-belt from which the ores and limestones above analytically described were taken.—the Richmond & Alleghany (soon to be the Atlantic and North-Western) leading to Richmond, the Norfolk & Western leading to Norfolk, and the Virginia Midland leading to Alexandria, all in Virginia.

In this belt, it is proper for us to say, is the "James River Specular Ore Property" that A. D. Robertson & Co. advertise for sale in THE VIRGINIAS.

Results of use of Great Kanawha Coals.

JED. HOTCHKISS, ESQ., Editor of THE VIRGINIAS :

Dear Sir :—I have read with much pleasure your last editorial in regard to the Kanawha coals as compared with those from the Pittsburg district, and noticing that the papers are to be continued, I give below two reports having a direct bearing upon the subject, which you are at liberty to use in any way that you think proper.

The first is from J. R. Ledyard Esq., Superintendent of the Kentucky Central RR., and is as follows :—"Our average consumption of Coalburg Coal (from the Robinson Coal Co's mines) is 30 pounds to mile of trains moved during year. Our runs have been : March 32.9 pounds, April 31.4, May 30.4, June 25, and July 27.6. These tests are upon "run of the barge." Youghiogheny (Pittsburg) runs 39 pounds to mile. with one test as low as 33.9. Ashland is 43 pounds to mile." In connection with this report Mr. Ledyard gave it as his opinion that 25 pounds of Coalburg coal would do the work proper of moving the trains.

The second report is from Gen. A. Hickenlooper, President Cincinnati Gas Light & Coke Co., and has reference to gas coal shipped from our mine at Cedar Grove (Blackburg seam) —"In response to your enquiries about the carbonization of your Cedar Grove coal, I have the honor to submit the following statement of the result of the test in our miniature works and two days use throughout the whole works. To make it more comprehensive I will institute a comparison with the very best Pittsburg coal (2nd Pool).

	Pittsburg.	Cedar Grove.
Yield per pound,	5.25 cubic feet	5.33 cubic feet
Purified per M. lime,	13.130 " "	16.000 " "
Yield of coke per 100,	1.94	1.70

The Cedar Grove coal is remarkably free from sulphur compounds and its purification is therefore less expensive. The coke makes an excellent fire, strong heat and has little clinker."

Prof. Ricketts in his report on this same seam gave a yield of 13,020 cubic feet per ton of 2240 pounds, with a candle power of 16.75.

Yours truly,

Neil Robinson.

ROBINSON COAL CO.,
Coalburg, W. Va., Nov. 21, 1881.

The Trade in New River of Kanawha Coals.

Dr. Thomas Egleston, of the Columbia College, New York, School of Mines,—an acknowledged authority on such matters here as well as in Europe—said, in some remarks made at the late Harrisburg, Pa., meeting of the American Institute of Mining Engineers, which appear in this issue: "It is a matter of great surprise to me that this coal has not already competed with the Connellsville." We say it is competing now, and will compete more and more as soon as more mines can be opened and more ovens made along its outcrops on the Chesapeake & Ohio Ry., now in operation and furnishing an "all-rail" way of transportation to all parts of the West, and when the lines of the Atlantic & Northwestern and Norfolk & Western railways, now in process of construction, shall give access to other portions of this coal-field.

Prior to the summer of 1873 these coals were unknown and inaccessible, and not a pound of them had been sent to market; now a great trunk railway, in operation from the grand harbor of Newports-News, at the Atlantic, into the heart of the Mississippi valley, runs for 50 miles or more along the escarpments of the canyon of New River in which three workable beds of this coal outcrop above the water-level, and where nine coal mines and five groups of coking ovens are in operation, from which during the first nine months of this year nearly 200,000 tons of coal and over 50,000 tons of coke have been sent to market. The surprise to us is that now, in the ninth year (including *all the "panic" years*) of the existence of mining operations in these New River coals, they should be so widely and favorably known, and that the difficulties incident to the opening of an entirely new mining region should be so overcome as to admit of an output of fully a third of a million tons of coal in that ninth year.

Before the close of another year the Norfolk & Western RR. will have reached and made accessible twenty-five miles or more of the outcrop, also above water-level, of five or six workable beds of this remarkable coal; and, from present indications, before three years shall have passed, the Atlantic & North-Western RR. will have given access not only to fifty other miles of its outcropings in the canyon of New River but to a hundred miles more in the lateral canyons of the tributaries of that river crossed by its line.—Then, a half dozen years hence, in the fifteenth year of its existence, when two hundred or more miles of "frontage" on New River coals are open to exploitation from lines of railway leading westward, we shall be surprised if these wonderful coals and their cokes do not come into competition not only with those of Pittsburg and Connellsville, but, for some purposes, with those of any part of this country that cannot show, by the "deductions of chemistry," coals and cokes equally pure and having as much *carbon efficiency*.

Lumber Traffic of Norfolk & Western RR.

Our last report of the timber traffic of the Norfolk & Western RR., page 137 of this volume, was to Sept. 1, 1881. Auditor E. E. Portlock sends the following statement of this traffic for September, 1881, in tons of 2,000 pounds.

Destination,	Lumber.	Logs.	Staves	Wood.	Totals.
Boston	159	16	....	....	175
New York,	378	212	....	....	590
Baltimore,	37	72	....	....	109
Philadelphia,	1	22	....	....	23
Norfolk,	768	37	662	....	1,467
Liverpool, Eng.,	....	....	45	....	45
Petersburg,	407	41	10	657	1,115
Lynchburg	171	....	....	....	171
Richmond,	206	...	20	....	226
City Point for outside,	40	276	....	....	316
City Point for Old Dom. SS. Co.,	106	10	....	....	116
Va, Midland RR.,	11	....	....	....	11
Way Stations,	240	....	....	....	240
Totals	2,524	686	737	657	4,604
From Tenn. & South,	761	186	333	....	1,280
No. of tons moved,	3,285	872	1,070	657	5,884

The tonnage of timber moved in Sept. was equivalent to about 2,942,000 feet, board-measure.

The August movement was 5,489 tons, so there was an increase of 395 tons, or over 7 per cent, in Sept. over Aug. The increase was wholly in sawed timber, lumber of the table, the gain having been 399 tons. This increased carriage of lumber is, of course, in consequence of the present activity in all kinds of building.

A new feature of this report is the direct shipment of staves from Norfolk to Liverpool.

The progress of the 1881 timber movement, in tons, was :

1881.	Lumber.	Logs.	Staves.	Wood.	Total.
January to October,	24,691	11,064	4,561	7,642	47,958

The timber traffic of this road will become one of large proportions as soon as the completion of its New River branch enables it to reach the magnificent forests of the great coal-field in the Great Flat Top mountain country, on the headwaters of Bluestone, Clinch, Big Sandy (Chatterawha), Guyandot and Coal rivers, now one of the best timbered regions of the United States, as it was one of the best timbered in the Carboniferous era, judging by the number and thickness of its coal beds.

Salisbury Furnace, of the Salisbury Iron Manufacturing Co., M. F. Maury, Supt., near Salisbury station of Richmond & Alleghany RR., Botetourt county, Va., is doing better work now than it has ever done since it was built. Up to Oct. 31, 1881, it has been in regular blast 222 days, and in that time has made 1,548 tons of cold-blast, charcoal, car-wheel iron from 4,252 tons of ore and 179,914 bushels of charcoal. About 2.7 tons of ore and 116 bushels of charcoal were used to the ton of iron made.

Iron Ores from Virginia, from Backbone station of C. & O. Ry, on the eastern slope of the Alleghany mountains—Oriskany, or No. VII ores—are now shipped in considerable quantities over the Chesapeake & Ohio Ry. and its extensions to the West. The *Independent*, of Ashland, Ky., states that Norton furnace of that place uses 8 or 10 car-loads of these ores daily, and Etna and Belfont furnaces, of Ironton, Ohio, from 3 to 6 car-loads daily.—In other words, the noted Hanging-Rock iron region is beginning to draw supplies of iron-ore from Virginia; its furnaces finding, we doubt not, that they are actually cheaper and better than the ores dug from their own lands and from their immediate vicinity. We have it from good local authority that the local raw materials for a ton of iron in that region cost from $16 upward. No wonder it is to their advantage to buy Virginia ores and West Virginia cokes at present prices. If any of the iron-masters of that once highly favored iron region propose to erect new furnaces we would suggest that they might find it ever more advantageous to erect such furnaces at or near the great stratified iron ore beds of Virginia.

Winifrede Coal Co.—Mr. Macfarlane, according to the *Coal Trade Journal*, has gone to W. Va. to take charge of coal mining operations for the Winifede Co., on its recently purchased coal lands near the Chesapeake & Ohio Ry. and the Great Kanawha river. That Journal says: "Mr. M. is well known in the Bituminous coal fields of Pennsylvania as an able and enterprising engineer and manager of coal works."—Managers of such a reputation are the ones needed to properly developed the great coal fields of West Virginia and introduce its coals to their legitimate markets. We welcome Mr. Macfarlane to the Great Kanawha field and wish him success in mining and again bringing into use the Winifrede coal. The office of this Company is at 307 Walnut Street, Philadelphia, Pa. Mr. James A. Wright is its treasurer.

The Ashland (Ky.) *Independent* states that the C. & O. Ry. daily brings to that town large quantities of *coke* from Fire Creek, Nuttallburg, and Stone Cliff, on New River, W. Va.; it also brings 10 tons of coke a day from the Eagle coal mines, on the Great Kanawha, to the Norton furnace.

West Virginia Coke is now used quite largely in the furnaces at Ashland, Kentucky, and Ironton, Ohio, as we learn from the Ashland *Independent* and the Ironton *Register*. It comes from the Fire Creek, Nuttallburg and Stone Cliff mines and coking ovens on New River, and from the Eagle mines and ovens on the Great Kanawha in through cars, by the Chesapeake & Ohio Ry., and its Kentucky extension.—The Norton Iron Works at Ashland, are supplied, by contract, with coke from the Eagle mine, made from Kanawha or Middle Measure coals, one that we learn gives great satisfaction, as it should, for we see no reason why the excellent and abundant coals of the Kanawha should not make as good coke as is made in the Connellsville region of Pennsylvania. They are fully as rich in carbon, the essential element in coke, as the coals of the "Pittsburg bed," those used at Connellsville, and contain, as a rule, less sulphur and less ash, the objectionable elements, than those coals,—as the analyses we published in our Oct., 1881, issue show. In fact, with the advantages now offered by all-rail shipment to any part of the West, cokes made in this region ought to compete successfully with any made in Pennsylvania; if they do not the coke makers and the railways are in fault.

Chesterfield, Va., Coal and Coke.—Jewett & Brother have had several offers for the fine seam of natural coke discovered on their land at Chesterfield, but they decline to sell, intending to mine it themselves. Jacob Baach is successfully working a coal mine in the same vicinity. The old Midlothian mine, of the Burroughs estate, is also successfully worked at this time; it and another mine in Chesterfield county, are worked at a depth of 1,000 ft.—the deepest coal mining in the U. S.—*Richmond Dispatch*, Nov. 12, 1881.

Cigaret Smoking.—Dr. Wm. A. Hammond has expressed a very strong opinion regarding cigaret smoking. He says parents should prevent their boys from smoking cigarets, which are worse than cigars, as the paper absorbs the nicotine. The effects upon growing boys are to destroy their appetite, stunt their growth, injure their voices and affect their memory. Let parents act according to the advice of Dr. Hammond. A habit, and we may well say a vice, so pernicious and injurious to youth and manhood should be corrected and prevented.—*Norfolk Virginian.*

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H. W. Sheffey, Pres. Davis A Kayser, Vice-Pres.
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Collections in Virginia and West Virginia promptly attended to and remitted on day of payment, at lowest rates of exchange

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FIRE CREEK COAL AND COKE COMPANY,

Fire Creek, Fayette Co., West Virginia,
MINERS OF
Red Ash Bituminous Steam Coal,

and manufacturers of **Hard Coke.** All correspondence should be directed to M. ERSKINE MILLER,
Sales Agent and Business Manager,
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W. A. BURKE,
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Sole Agent for Nuttallburg Coal & Coke;
The best steam coal on the market; coke superior to Connellsville.
Shipper of Kanawha Splint and Gas Coals.
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RATES GREATLY REDUCED AGAIN TO SUIT THE TIMES.

BOARD $2.00 AND $2.50 PER DAY.
Fire Proof. Accommodates 400.

This splendid new hotel is situated in the heart of the city, and adjoining the beautiful Capitol Park, with its Statuary, Monuments, Fountains, Groves, and Flower-beds; is newly and elegantly furnished throughout. It is convenient to all the Depots and Fine Coaches run to and from all the Stations and Steamboat Landings.
Special suits of rooms will always be kept in readiness for wedding and other large parties.
Notice.—The delightful climate of Richmond is unsurpassed, thereby claiming the attention of tourists and invalids.

VIRGINIA HOTEL,
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The "Old Reliable." The People's Favorite. Complete in all its Appointments.

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Lynchburg Iron, Steel and Mining Co.,
WORKS AT LYNCHBURG, VIRGINIA.

Manufacturers of Bar and Loop Iron, Railroad Spikes, Fish Plates, and Bolts. Also, Machine Work of all descriptions. SPECIALTIES:-Blast Furnace and Rolling Mill Machinery, Hydraulic Cotton Screws, Mining Machinery and Bridge Work of all kinds. Office, 319 Walnut Street, Philadelphia

Real Estates, Water Power, &c.

MAGNIFICENT WATER POWER, FOUNDRY, MILLS, &c.

For Sale in Danville, Virginia.

Pursnant to a decree of the Corporation Court of Danville, Va., in the chancery cause of W. J. Crews against Rodenhizer's administrator and heirs, we offer at private sale, until the 20TH DAY OF DECEMBER, 1881, the entire

WATER POWER, FOUNDRY, AND MACHINE SHOP, MILL SITES, &c.

now owned by Corbin & Crews, and Crews & Rodenhizer's heirs, particularly described in the bill and exhibits filed in said cause.

For further information address undersigned at Danville, Va.

Notice will be given in case of sale privately, but if not sold privately before, we will on the

20TH DAY OF DECEMBER, 1881, AT 11 O'CLOCK, A.M

sell on the premises, in Danville, said

Water Power, Foundry, and Machine Shops, Mill and Sites, &c.

at Public Auction to the highest bidder.

The property will be first offered in different lots, with fine water power attached to each, and then as a whole, and the Commissioners reporting the highest aggregate bid.

This magnificent water power, supplied with water by canal from Dan river, is capable of wonderful development, in addition to its present capacity, which is ample.

TERMS:—Fifteen per cent of the purchase money to be paid cash, the residue in three equal installments of one, two and three years, the purchaser to give bonds for the deferred payments, bearing six per cent interest from the day of sale, and when the purchase is completed, and on the compliance with the terms of sale, the title to be conveyed to the purchaser, and the purchaser to convey back the property in trust to secure the deferred payments. If desired, application will be made at once to allow any purchaser to pay all his purchase money cash.

This is a splendid opportunity to parties desiring sites for cotton, woolen, grist, flour and rolling mills, foundries, &c., &c. and nearly all kinds of manufactories in the growing city of Danville.

E. E. BOULDIN, E. B. WITHERS, Danville, Va. } Comm'rs.

Immediately after the above sale is through I will sell the patterns and machinery, &c., belonging to the old established foundry and machine shop of forty years standing. Terms made known at the sale.

W. J. CREWS,
Last surviving partner of Crews, Bodenhizer & Co.
oct and nov.

THE PAINT CREEK MINING Properties of Kanawha County, West Virginia.

PAINT CREEK MINING CO., (On west side of Paint Creek.) **10,000 acres.**

WACOMAH MINING CO., (Adjoining the lands of othe Co., but mainly on the east of Paint Creek.) **4,700 acres.**

PAINT CREEK RAILROAD CO. (From mouth of Paint Creek up the same.)

All under one management with same directors and same stockholders holding same ratio of interest in each company.

L. L. CONRAD, of Baltimore, ...President.
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Geo. W. Riggs, of Washington.
H. H. Parker, of New York.
John S. Barbour, of Alexandria, Pres't Va. Midland RR.
James F. Patton, of Union, Monroe Co., W. Va.
Wm. H. Edwards, of Coalburg, Kanawha Co., W. Va., Pres't of Kanawha and Ohio Coal Co.
Isaac N. Smith, Charleston, Kanawha Co., W. Va.

Isaac N. Smith, of Charleston, Kan. Co., W. Va., ...Solicitor.
Oscar A. Veazey, of Paint Creek, Kan. Co., W. Va.,..Engineer.

These companies have been organized for the development of valuable coal loads owned by them. They are now constructing a first-class railway through the properties, having its terminus in the pool above Lock and Dam No 3, part of the improvements now being constructed by the U. S. Governmen on the Kanawha River. This railway will be completed and equipped for transportation of coal in September, 1881. It crosses the C. & O. Ry. and connects with it, so that shippers will have every facility for both river and railway trade.

The companies are prepared to make leases to reliable parties and to ship the coal of their lessees to river and rail upon most favorable terms.

Their Cannel, Splint, Bituminous and Coking Coals are unexcelled in quality, quantity and size of workable seams—the principal splint coal seam averaging ten feet.

Application for leases may be made to the President direct or through any of the Directors.

More particular information given upon request, by mail or otherwise, to L. L. Conrad, President, 15 Lexington street Baltimore, or Isaac N. Smith, Charleston, Kanawha county, W. Va., Solicitor of the Companies.

THE OLD BLACKFORD FORGE PROPERTY,

Including Water-power and Over 600 Acres of Land,

On Hawksbill Creek, Below Luray, Page County, Virginia,

And on line of Shenandoah Valley Railroad, is hereby offered for sale. For terms, etc., address

Lock Drawer 2, Staunton, Va.

PAINTS AND MANGANESE.

I offer for lease, on liberal terms, the deposits of **Manganese and Mineral Paints,** consisting of Ochre, Umber, Terra di Sienna, Carbonate of Iron, &c., upon my estate near Fishersville Depot, on Chesapeake & Ohio Railway and line of Shenandoah Valley Railroad, in Augusta county, Virginia. Examination invited. Correspondence may be had with the undersigned at Fishersville, or his counsel, Thomas D. Ranson at Staunton, Va.

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625 ACRES OF NEW RIVER COKING COAL LAND can be leased for a term of fifteen or more years, upon a royalty of seven cents per ton (of 2240 lbs) with option of purchase, to parties who are responsible, and willing to begin work at an early day.

Address G. M. BLUME,
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Sept. and Oct.

RESIDENCE IN STAUNTON FOR SALE.

I offer for sale the Residence of Mrs. Virginia B. Donaghe, fronting on three of the principal streets—Main, Lewis and Frederick—in immediate proximity to business, churches, schools, &c. The improvements are first-class, and the property one of the best, if not the very best in the city, either as a home or a speculative investment. It will be subdivided if not sold as a whole. Examination invited.

Terms:—Ten per cent. cash, and balance at one, two, and three years, with semi-annual interest.

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FIRST-CLASS CHARCOAL FURNACE,

Now in blast, with stock and fixtures, for sale. Makes the best car-wheel iron.

Also, 50,000 acres of land in one tract, 12 miles from A. M. & O. RR. Contains splendid timber, Manganese Ore, and Brown Hematite Iron Ore, ***free from phosphorus and sulphur,*** **suitable for making best car-wheel iron. Will sell in sections of 5,000 acres or more, or as a whole. Title guaranteed and no squatters. For full report, address,**

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COAL AND TIMBER LANDS FOR SALE OR LEASE.

The undersigned, as President of a Land Company, has for sale or lease, on favorable terms, some of the best coal and timber lands in the New River District, on the line of the Chesapeake and Ohio Railway. The coals on these lands are the **Coking Coals,** the coke from which is now so much in demand for blast-furnace and other metallurgical uses. For further information and terms, apply to

SAMUEL COIT, President,
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TIMBER LANDS FOR SALE.

I offer for sale an undivided one-fourth interest in 64,781 acres of timber lands, in Wyoming Co., Va., and situated on a branch of the Guyandotte river.

The land is heavily timbered and abounds in COAL AND OTHER MINERALS. The other three-fourths are owned by Northern capitalists.

For further information and terms, address,

WM. HEALD,
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JAMES RIVER SPECULAR ORE PROPERTY FOR SALE.

We offer the fee simple in the MINERAL RIGHTS on 750 acres of land, immediately on the James River Canal and the Richmond & Alleghany RR. This property is situated a short distance below Riverville, in the heart of the magnetic and specular ore belt of the James River Valley. It is one of the most valuable iron ore properties now on the market—the deposits being very large, and the ore of the purest quality. Price $16,000.

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For other particulars apply to J. L. CAMPBELL, Jr.,
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The Twelfth Session of this school will open the 1st Monday in September, and continue Forty Weeks. With all the equipments of a first-class school, the cost of a pupil is far below that of most schools of like grade, because of more moderate rates, but especially on account of the economy that is required of ALL pupils in DRESS, PRESENTS, SHEET MUSIC, &c. The cost of a pupil for Board, Tuition in Literary Course, Washing, Lights, and Furnished Room, for ten months, $210. Extras FEW and MODERATE. Send for circulars and catalogue.

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For particulars, address, FRANCIS H. SMITH,
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DAVIS CREEK, W.VA., COAL AND IRON LANDS.

I offer for sale a tract of land on Davis Creek, about 6 or 8 miles from C. & O. Ry. and Kanawha River,

Containing 2,200 Acres,

This land lies about midway between the tracts of the Terragonta Co. and the Black-Band Iron & Coal Co., and like them, contains CANNEL COAL, and is believed to contain the same beds of BLACK-BAND IRON ORE.

For particulars apply to JAMES F. LEWIS, Charleston, W. Va., or to the undersigned at Staunton, Va

I have permission to refer inquirers to the Editor of this journal, Maj. Jed. Hotchkiss.

I also offer one undivided fourth interest in the "Gallatin tract (3000 acres) of coal land, embracing the entire main falls of the Kanawha Falls. This tract is run through by the Chesapeake & Ohio Ry. and has a river frontage of about two miles on Kanawha and New Rivers, and is heavily timbered.

Also a tract of 420 acres on Pocatalico river, in Roane Co., very finely timbered in oak, hickory, ash, beech and poplar. This is a splendid grass and stock region. The title to all these lands is unquestionable.

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The Virginias.

A Mining, Industrial and Scientific Journal:

Devoted to the Development of Virginia and West Virginia.

Vol. II, No. 12. } Staunton, Virginia, December, 1881. { Price 25 Cents.

The Virginias,

PUBLISHED MONTHLY,

BY JED. HOTCHKISS, - - - Editor and Proprietor,

At 346 E. Main St., Staunton, Va.

Terms, including postage, per year, in advance, $2.00. Single numbers, 25 cents. Extra copies, $20.00 per 100. Back numbers, from the first, can be had at 25c each.

Advertising, per inch of length of single column (3 columns to a page, as on advertising pages), one month, $2.50; two months, $4.00; three months, $5.50; six months, $7.50; nine months, $10.00, and twelve months, $12.00; payable in advance.

Specimen Numbers of this journal are sometimes sent to parties supposed to have an interest in the development of the Virginias, or a desire to be informed in reference to their resources, improvement, etc.; they will please consider this an invitation to become subscribers and so help to sustain a paper devoted to their interests.

On sale at Hunter & Co.'s Bookstore, Main Street, Staunton, Virginia.

Entered at Staunton, Va., Post-office, as second-class matter.

The Virginias for 1881, the Second Volume of this journal, a quarto of 200 pages illustrated by maps, geological sections, etc., fully indexed and substantially bound, will be sent by mail, prepaid, to any address in the U. S. on the receipt of Three Dollars.

Volume II. of the Virginias is completed by the issue of this number; the index to it will be sent some time next month. We have spared neither time nor expense to make THE VIRGINIAS fulfill its special mission, that of the development of the resources of Virginia and West Virginia, especially their mineral ones; we hope our work has been done in a way satisfactory to our numerous subscribers, and that they will show their appreciation of it by a prompt renewal of their subscriptions, and by aiding in extending our circulation. We congratulate them on the prosperity that the Dispenser of all good and the Disposer of events now grants us, and wish them all a prosperous and happy new-year—except the few that have failed to pay for THE VIRGINIAS for 1881, and to them when they have so paid.

The Virginias for 1882 will be sent only to those that pay for it in advance, and for the whole year; so please promptly send us $2 for a renewal of your subscription which ended with 1881.

Arrangements have been made, at an expense of thousands of dollars, for adding largely to the value of THE VIRGINIAS during the coming year; one of these is the publication of a series of Geological Maps of Counties of Virginia and West Virginia, prepared from original observations, and engraved and colored in the best style of the lithographer's art—similar and equal to the elegant ones that the state of Pennsylvania is now publishing for its Second Geological Survey. These maps will be accompanied by a complete physiographical description of each county, making the number containing it a most valuable hand-book for the county treated of. The county of Rockbridge, a central one of Virginia, one rich in mineral wealth and having most interesting geological features, will appear first, its geology and mineralogy by Prof. J. L. Campbell, and other topics by competent Rockbridge men.—We expect the good people of these counties to become subscribers to THE VIRGINIAS and so secure these costly and valuable maps.

An illustrated article, of very great interest, by Prof. W. M. Fontaine, is now in hand for publication. Other new features for 1882 will be announced hereafter. In the future, as in the past, THE VIRGINIAS will continue in the front rank, in all particulars, with journals of its kind.

Recent Compliments of our Cotemporaries.

We have *The Virginias* for November and have used our scissors quite freely on this volume. We believe this paper is doing Virginia and West Virginia more good than any one journal in both, for besides having the most profitable line of work, it has a fine location and a most accomplished head man. An article in it in regard to iron ore and limestone near this city will do our section good.—Lynchburg *Advance*, Dec. 6, 1881.

The Virginias is an able and reliably edited mineral magazine, published at Staunton, Va.—*State Tribune*, Charleston, W. Va.

"*The Virginias* is itself an exponent of, and a vindication of the South, which will not suffer by comparison with any other publication of its kind."—*Textile Record of America*, Lorin Blodget editor, Philadelphia, Pa.

Col. J. Irwin Gregg, of U. S. Army, sending us a subscription for 1882, kindly writes: "I have had the privilege of looking over your Volume for 1880, with which I am greatly pleased."

Attention is Invited again to the Davis Creek coal and timber lands that Hon. Wm. Frazier offers for sale in our advertising columns, since in our last issue the vendor's name failed to appear with the advertisement.—We desire to say, in addition to what we have said before, that in commending these lands to investors we speak of them from a personal knowledge of their value as mineral lands. A large force is now at work constructing the railway up Davis Creek from the Chesapeake & Ohio Ry., so it will be but a short time before these lands will be directly accessible by rail.—In reference to the Roane county lands offered by Mr. Frazier we cannot speak from a personal knowledge, but we will endorse as reliable whatever he may say about them.

We call the attention of those having gas-wells to sell to Mr. Montague's enquiry, in our advertising columns, for one.

The Traffic Information that we publish from the various railways is closely scanned by metal and mineral dealers in all directions. We often receive letters asking for fuller information about the origin, etc., of these items; such an one is just to hand from our esteemed Liverpool, Eng., advertiser, George G. Blackwell. We find it difficult to get our railway officials to give us this information in detail, and yet we know of no way by which they can keep those interested informed about what can be furnished from their lines as good at this one. Please give us full information so we can inform the public what metals, minerals, etc., you transport, where they come from, who sends them, and where they are going.

Pittsburg Coal Shipments.—The Pittsburg *Telegraph* of Dec. 24, records the departure, down the Ohio, about the time of its issue, of 27 steamers towing 161 boats and 207 barges, containing 5,071,000 bushels (or, at 76 lbs to the bush. 192,698 tons) of coal for Cincinnati and Louisville; of this coal 1,666,000 bushels went to the former city, and 4,405,000 bushels to the latter. Commenting on this shipment the *Telegraph* says:—"In Cincinnati, Pittsburg coal afloat is now worth between 11 and 12 cents per bushel, a price which, according to some shippers, barely leaves a margin of profit. The expense attending the getting out of coal includes these items: Royalty to owner of land, bank expenses, repairs, taxes, which, with ½ cent for lockage, brings the cost afloat at the lower landings at 6½ cents. Allowing two cents for towing to Cincinnati and return expenses, there would still seem a very fair margin for the dealers even were the prices at Southern ports still lower."

In New Orleans, as the same paper states, the consumption of Pittsburg coal has increased from one of 2,448,000 barrels (or at 9⅜ barrels to the ton, 262,380 tons) in 1875, to one of 3,627,100 barrels (about 390,000 tons) in 1881.

On this matter Miltenberger & Co., of New Orleans say:—"The consumption of 1881 has been in excess of any previous year, by 310,000 barrels, and the average wholesale price, 45¼ cts. per barrel, better than any year since 1873, when the average figure reached nearly 60c per barrel. To the increased number of foreign steamers plying to this port, the rapid growth of manufacturing industries in this city, and the demands for family use occasioned by the unusual severity of the winter of 1880-81, together with the general improvement in all branches of trade, may be attributed the increased consumption of coal for the past season.

Several new towing steamers went out for the first time on this rise, among them the W. W. O'Neal, that cost $80,000, (the *Telegraph* has it $8,000, but says it is the largest of the new ones) and is 200 ft. long; the S. L. Wood, that cost $65,000, and the Sam. Brown that cost $60,000.

The wholesale prices of Pittsburg coal, Dec. 22, 1881, according to the *American Manufacturer*, were, per ton: $1.86 at Pittsburg, $3.17 at Cincinnati, $3.17 at Louisville, and $3.88 at New Orleans; the retail price, delivered, was $2.65 per ton at Pittsburg, $4.23 at Cincinnati, $4.23 at Louisville and $4.85 at New Orleans.

Importations of Iron Ore and the Tariff.

The "Bulletin of the Am. Iron & Steel Association" reports, from official sources, that in 1881, up to Nov. 1, 724,210 gross tons of iron ore, valued at $2,056,052 were imported into the U. S., as against 493,408 tons in the year 1880, and 284,141 tons in the year 1879. Of the above import of this year 355,-338 tons came to Baltimore, 177,681 to New York, 140,858 to Philadelphia, and less than 14,000 tons any other point.—In the "N. Y. Coal Trade Journal," of Dec. 7, we find this item: "The Marvel Iron Co., with a capital of $1,000,000, has been organized. W. D. Marvel and Jos. K. Wells are largely interested in the enterprise. The company will mine ore in Spain and bring it to America."

We desire to call the attention of the Virginia owners of iron ores, a very numerous body of men we are pleased to know, and our few but very zealous "free-trade" newspapers, to the above items. Can they tell whereunto this thing will grow? The importations of 1880 were over 70 per cent more than they were in 1879, and the importations of 10 months of 1881 have been over 46 per cent more than they were during the year 1880. At this rate, unless the importation is checked by the imposition of a healthy duty, how long will it be before foreign ores will take the place of most native ores in every part of the country, within 500 miles of the Atlantic sea-board, penetrated by the westward trending lines of railway fully possessed of the notion that they can afford to carry freight westwardly—*that is imported freight*—much more cheaply than they can that bound eastwardly.

Let us see how this case stands when we "count the cost." The ore so far imported this year had an average value of $2.84 per ton; adding to this value the present duty of 20 per cent *ad valorem*, the ore cost delivered on the wharves of the cities above named $3.41 per ton. We have it from one of the large users of foreign ores in Pittsburg, Pa., that these ores are carried to that city from Baltimore, now the largest importer of these ores, as above shown, for .7 of a cent a ton a mile. By the B & O. RR. it is 259 miles from Baltimore to Pittsburg, so the freight charge is $2.22 per ton on these ores, so they are put down in Pittsburg at about $5.62 per ton. These ores are now sold to the Pittsburg furnaces at about $7.50 per ton.

It should be borne in mind that we have taken the average of *all the ore imported* in the above. If we turn to the Report the Chief of the U. S. Bureau of Statistics, No. 1, 1880-1, p. 109, we will see that in the last half of 1880 we imported iron ore from 16 different foreign countries, but the largest quantity came from Spain, 213,446 tons valued at $213,446, or but $2,20 per ton, or $2.64, duty paid. Now turning to Vol. IV, p. 316, of the recently published U. S. Reports on the Paris Universal Exposition of 1878, we find that these Spanish ores, (more than a million gross tons of which were mined even in 1877, mainly for export) contain from 56.52 to 58.80 per cent metalic iron, and are remarkably pure,—so these are high grade ores.

Now what is the cost of iron ore in the United States? Fortunately we have at hand in Bulletin No. 270 of the Census Office, the actual figures in 1880: from that it appears the "average price per ton of ore *at the mines*," in the U. S., was $2.90 per ton of 2,000 lbs.; that the actual cost of labor per ton mined was $1.35, and that of material $0.41, or $1.76 for these items, leaving but $1.14 to cover interest on investment and plant in and at mines, amounting to about $61,782,287, and for royalties paid, which amounted to $981,170, and for profits; —labor alone received 46.57 per cent of all the ore brought at the mines. Some significant facts are brought out in the comparison made between the results of the census of 1870 and that of 1880. The *loss* in the value per ton of product in 1880 was 25.45 per cent, and that in the yearly income of man employed was 32.13 per cent. The importation of iron ore during the 1880 census year was 701,451 tons, or about 1-11th of the whole production of the United States. Will any one say that this importation had nothing to do with the *loss* of 25.45 per cent to the capitalist and employer, and that of 32.13 per cent to the laborer?

We submit whether we can successfully and profitably compete in mining iron ore to sell at $2.90 per ton at the mines of the United States for ores that are mainly *low grades*, when *high-grade* foreign ores can be delivered at Richmond, Norfolk, Petersburg, West Point, Alexandria, etc., in Va., and at Baltimore—from all of which points railways with western tendencies penetrate the Virginias—valued at but $2.20 to $2.84 per ton, plus the nominal duty now collected.

We would like to have our highly esteemed free-trade Lynchburg cotemporary "calculate" how much *less* these high-grade foreign ores would cost there than those of the same kind mined in sight of that city if the Richmond & Alleghany RR. should become "cranky" with westward "tendencies" and take such ore from Richmond to Lynchburg at .7 of a cent aton a mile?

There is no more vital question to-day in the development of the iron mining industry of Virginia than that of protection from foreign ore, as well as from foreign iron. Situated as we are, penetrated by deep tidal waters almost as far to the westward as the central meridian of Pennsylvania, we are especially vulnerable in this particular.—We invite the attention of the Senators and Representatives of the Virginias in Congress to this question. We cannot see how any one of them can hesitate to advocate a high duty upon foreign iron ore.

The South and the Tariff.—We have several times intimated that in our opinion, the time has come for Southern Democrats to abandon their hostility to the tariff, believing that upon that particular question the North will outvote them all the time. Obviously, the principle of protection was never before as strongly endorsed by the people of the United States as it is today, and upon that single issue, the majority would vote in favor of protection in any national election. The dogma, whether right or wrong, cannot be reasoned out of the minds of the people; and the time may be remote, when the doctrine of free trade, as it exists in older countries, shall take possession of the minds of a majority of our people. In this view, our able Southern contemporary, the Mobile *Register*, is induced to say:

"The South will in time compete with New England if we have equal opportunities, but if a tariff for revenue only without incidental protection to home industries should be established, we will find our infant manufactories breaking down before the vast and wealthy establishments of the North which have grown strong under several generations of government favor."

As we said the other day, in accepting the prediction of a Boston contemporary, it is not improbable that the time may come when the North will be in favor of throwing off protection, and the South will clamor for it. At all events, it would seem to be the part of wisdom in the South to "make hay while the sun shines." We have the protective tariff now, and will have for some time to come, and the best policy for us is to profit by it, so that what we pay for protection against foreign manufactures, may enure, as far as possible, to the benefit of our section, in encouraging manufactures that will give employment to our own people, and the profits thereof aid in building up our own industries."—*Lynchburg Virginian*, Dec. 21, 1881.

Virginia's Position, according to a diagramed argument in the Bristol, Va.—Tenn. *News*, the paper of which Mr. J. C. Fowler, present Speaker of the House of Delegates of Virginia, is editor,—is now with the manufacturing rather than with the cotton-producing states, and therefore, having similar interests, her policy should be in accord with that of the manufacturing states on the question of protection to manufactures, mining, etc., by a properly regulated protective tariff. It propounds this question:

"Shall we fail to note the fact that the people of the Cotton Belt are not sending a dollar to Virginia to build a railroad, nor to open a mine, nor to light a furnace? Shall we refuse to see that Northern men are building every projected railroad and opening every coal and iron mine in Va., and are erecting those pillars of fire that now light up the James River Valley and will soon illuminate the Southwest?"

Gas-works Test of Great Kanawha Coal.

"Test Works Cincinnati Gas Light & Coke Co.
Cincinnati, June 16, 1879.

Results obtained from Crescent Mine Kanawha Coal furnished by W. R. Johnson, Jr., Coal Valley, Fayette county, W. Va.

Weight per bushel, 71 pounds.

Weight of charge 262 lbs.		Time carbonizing 5 hours.	
Produced 1st hour 363 cu. ft.		Candle-power, jet	30
" 2nd " 338 " "		do do.	19.60
" 3rd " 316 " "		do do.	17
" 4th " 282 " "		do do.	10
" 5th " 143 " "		do do.	2
Total, 1,442 " "		Average,	15.25

Yield of gas per lb. of coal 5.50 cub. ft. Candle-power, Bun., 15.25. Candle-feet 83.87.

Purified per bushel hydrate of lime 17,000 cub. ft.

Weight of fixed carbon 168 lbs.

Coke 4.25 bushels. Breeze 0 bushels. Tar made 1.51 gallons. Ammoniacal liquor (6°) 1.30 gallons.
Inlet of condenser 71°. Scrubber 70°. Atmosphere 72°.—Outlet of condenser 70°. Meter 70°. Barometer 29.65.

Remarks.

Coke produced 1.62 bush per 100 lbs. coal carbonized.
Tar produced 12.81 gals. per ton of coal carbonized.
Ammoniacal liquor produced 10.01 gals per ton of coal carbonized.
Fixed carbon 14.35 lbs. per ton of coal carbonized.
Gas 12,320 cu. ft. per ton of coal carbonized.
Coke very good, a little softer than Yough. Coal rather soft, would break in handling.

J. Fullager, Supt.

Pittsburg vs. Great Kanawha Coals.

(Continued from page 169.)

Since the publication of the editorial under the above caption in our November number, the following editorials and trade reporter's note have appeared in the columns of the *American Manufacturer*, of Pittsburg Pa., replying to our strictures on its previous comparisons of Pittsburg and Great Kanawha coals and our statements concerning them.—We print its articles in full, just as we find them.

"In the MANUFACTURER of September 30 our market reporter stated in his coal report that Pittsburg coal was superior for all purposes to any other coal sent to Cincinnati and Louisville and that for gas manufacturing it was indispensible. These statements have called forth a lengthy reply from our valued and esteemed contemporary, *The Virginias*, for October, in which appear several analyses of Pittsburg and Kanawha coals and the assertion that the MANUFACTURER 'improves every opportunity that offers to laud Pittsburg coal and disparage those other regions, especially those of the great Kanawha basin,' &c.

In saying that the MANUFACTURER improves every occasion to laud Pittsburg coal and disparage the coal of other regions, *The Virginias* does us great injustice. We have never gone out of our way to laud Pittsburg coal, and we challenge our contemporary to point to a single instance where we have disparaged other coal. We have not, and never have had, a feeling of that kind. If West Virginia, or any other section, can produce better coal than that mined in this vicinity we shall be glad, and will not hesitate to publish the fact. Our "patriotism" is not hemmed in by state lines. If our reporter has been lead to believe that Pittsburg coal is superior to Kanawha coal, and has on two or three occasions so stated, simply as a matter of fact and as pertinent to other matter in his reports, it does not afford ground for the charge made by our contemporary.

But *is* Pittsburg coal superior to Kanawha coal "for all purposes?" and *is* it "indispensable" for gas manufacturing?—Our reporter should doubtless have somewhat modified his statement. It is possible that there are some particular purposes for which Kanawha coal is better than Pittsburg coal; and it is certain that Pittsburg coal is not *indispensable* for gas manufacturing. Nevertheless, the course of those who have access to both coals is pretty conclusive evidence that the latter is preferred for gas purposes as well as for most, *if not all* other purposes. They pay a cent more per bushel for it in Cincinnati, and the gas companies in all the towns and cities throughout the West use it exclusively. Even Parkersburg is, or was very recently, lighted with gas made from Pittsburg coal.

These proofs, we take it, are stronger than those afforded by the analyses published by our contemporary; for analyses, valuable though they are, are not so conclusive as the demonstrations of practical tests.

Before closing, we desire to explain that in what we have said above we have not sought to laud Pittsburg coal nor to disparage Kanawha coal. We have simply given, in self-defense, what we believe to be well-demonstrated facts. Far from disparaging West Virginia as a great coal-bearing region, we desire to say that her coal deposits are wonderful in magnitude, great in variety, and most excellent in quality, and we have never been backward about publishing these facts to the world. We have always been swift to publish facts in relation to the mineral wealth of every non-developed or newly developed region, and this will be our course in the future. Our readers are not confined to Pittsburg and vicinity, but may be found in every section of the country, as well as in other countries, so that even if we were disposed to laud local interests and disparage others, it would not be to our interest to do so."—Editorial of *American Manufacturer* of Dec. 2, 1881.

"It requires our esteemed contemporary. *The Virginias*, a long time to load and fire, but when its gun does go off it delivers a regular broadside—two or three pages—and at the time it appears that nothing within range can survive. But there is a weak place in our contemporary's gunnery—its markmanship is bad; when it aims at coal it is liable to hit coke. It has fired two broadsides at Pittsburg coal, and yet said coal is still used by all the gas companies in the West, and the Cincinnati papers (we quote from the *Gazette* of Nov. 28) continue to speak of it as follows: "The prices per bushel prevailing in Cincinnati at the closing of Saturday's market were as follows: In barge, Kanawha, 15 cents; Pittsburg, 16 cents; in 200 bushel lots, Kanawha 17 cents; Pittsburgh, 18 cents; in 25 bushel lots, Kanawha, 18 cents; Pittsburg, 19 cents." We await the results of our contemporary's next broadside, which is promised a month hence."—*American Manufacturer*, editorial, Dec. 9, 1881.

"*The Virginias* still claims the superiority, or at least the equality, of the West Virginia coal to that of Pittsburg, and rests its claim upon chemical deductions, slurring the decisions of experience, which are exactly the reverse. The heaviest coal operators in the Kanawha region are the Marmet Mining Company, who are also the largest coal dealers in Cincinnati. They buy Pittsburg coal and pay for it one cent more a bushel than they sell the Kanawha coal at. They care nothing about the superior elements shown by chemistry to be in the Kanawha coal, nor is it likely they have ever inquired into the matter at all. They know the Pittsburg coal is far the best for generating steam, the pleasantest for domestic uses, and beyond comparison the most profitable in the manufacture of gas. With this knowledge, and that of the higher price, all consumers are willing to pay, this shrewd firm is content to treat it as the best coal, ignoring altogether the contrary decision of chemistry, if indeed it is against the superiority of Pittsburg coal. The believers in the infallibility of chemistry upon the virtues of bituminous coal will have to look to it and see whether the analytical processes have been correctly made—it will never do to strive to overthrow the uniform conclusions of experience by speculative assumptions however specious, for it is throwing ashes to the windward. It is hard to convince people against the evidence of their senses, even though chemistry decides against it."—Coal and Coke report of *American Manufacturer*, 9, 1881.

In reference to these extracts from the *American Manufacturer*, we wish to say, "ever and always," that in commenting on them, or on any previous statements of that journal instituting comparisons between the "Pittsburg" coal and the coals of the Great Kanawha, we wish it to be distinctly understood that we do not call in question the catholicity of the "patriotism" or generosity of our cotemporary.—We do not hesitate to say that we know of no journal of its class in the Union that has said so many kind and good things about the mineral and other resources of the Virginias and the advantages they offer for investments and for manufacturing, and that has so freely opened its columns to communications about these things; and we have advised, and shall continue to advise all our people interested in coal and iron, in any way, to subscribe for and read that identical journal. In fact its books will show quite recent additions to its list from our environment. We esteem it highly "for its works' sake," and therefore we have a kindly consideration for all its doings and sayings, and a sort of right to call them in question when the "Pittsburg" smoke gets somewhat thicker than usual and needs "lifting" to give our friend "a little more light," even if it becomes necessary to "enrich" Pittsburg gas by the addition of some made from Great Kanawha coals.

(In this issue we have only space to call our cotemporary's attention to several articles in it that bear directly on the questions of this controversy. We shall have more to say hereafter.)

Great Kanawha vs. Pittsburg Coals for Gas-making.

One of our most esteemed Pittsburg, Pa., cotemporaries claims in its issue of Sept 30, 1881, that Pittsburg coal "*is indispensible for gas manufacturing*," *asserts further in its issue of Nov. 25th*, 1881, that "*it is exclusively used for making gas in all the works in the Mississippi valley, even at Wheeling, Parkersburg and Huntington, together with all places where gas is used on the Gulf and Atlantic coast save northward where it is met by the Liverpool coal, its only equal we believe, as yet discovered in the world. At all the interior cities, Cumberland, Washington, Harrisburg, Williamsport, Buffalo, Syracuse, Albany, &c. the same coal is relied upon in their gas manufactories. And—but we may be mistaken—we think it is used at Richmond, Petersburg, Norfolk, and pretty much all other gas-making places in our country, and that it is only superseded by Liverpool coal where that can be obtained the cheapest.*" And again, in its issue of Dec. 2, 1881, after backing out from its former position and saying—"it is certain that Pittsburg coal is not *indispensible* for gas manufacturing," it still insists that "the gas companies in all the West use it exclusively," though conceding, by omission to reassert its former claim, that some other coal besides Liverpool may supersede it in the East. And, finally, in its issue of Dec. 9, 1881, after wildly waving the "black-flag" in the face of the "deductions of chemistry" by asserting that "it will never do to overthrow the uniform conclusions of experience by assumptions however specious," it undauntedly asserts that Pittsburg coal "is, beyond comparison, the most profitable in the manufacture of gas."

These claims—mere assumptions it would seem from the facility with which positions are taken, shifted, or abandoned; one day claiming that Pittsburg coal is "*indispensible*" for gas making, another that it is "*exclusively*" used, and another that it is the "*most profitable*"—we consider it our representative duty to examine and see whether they are founded on facts, that the place and gas-making value of the gas-coals of West Virginia, those of the Great Kanawha especially, that are now coming into competition with these Pittsburg coals in all the important markets of the country for such coals, may be known and understood.

We did not invite this comparison of merits, but finding it made, positively and repeatedly, by our Pittsburg representative, and regularly quoted and circulated, without comment or dissent, by a representative journal of this trade in New York city, we do not hesitate to accept the "trial by comparison," and to assert, with proof to sustain our assertion: (1) That Pittsburg coals are not "indispensible" in gas-making; (2) That they are not "exclusively used" either in the East or in West; (3) That they are not the most profitable in the manufacture of gas"; and (4) That the coals from the Great Kanawha field (not, at this time, to mention those from other parts of West Virginia), those from several beds that are accessible, above water-level, over thousands of square miles of country, are in all particulars, at least the equals of the best Pittsburg.

The requisites of a good gas-coal, at this time, both science and experience positively assert, are, in general, that it shall be rich in volatile combustible matter, free of sulphur, and yield a good coke,—that is, a coal that will yield a large amount of pure gas having a high illuminating power, and leave as residue considerable quantities of good coke, gas-tar, and ammoniacal liquor, and a small amount of waste.

We have shown (See pages 168-9 of our Nov. No.) by reliable chemical analyses, that some of the Great Kanawha gas coals, omitting cannel, contain 2.4 per cent more volatile matter than the best Pittsburg,—or 8.4 per cent more including cannel, which is a plentiful coal in the Great Kanawha field. Comparing the sulphur and the ash constituents the results are equally in favor of the Great Kanawha coals.

The tests of use in Western gas works confirm the conclusions reached from chemical analyses as to the high character of these coals, in all particulars, for gas-making purposes, as proven by the following:—

(1) By trial of Crescent (Great Kanawha) coal in Test Works of Cincinnati Gas-Light and Coke Co.—a corporation that makes 500,000,000 cubic feet of gas a year—which we publish elsewhere under the heading of "Gas-Works Test of Great Kanawha Coal." Concerning that coal and test, under date of June 30, 1879, Gen. A. Hickenlooper, President of that company, wrote to the proprietor of the Crescent mines, Capt. W. R. Johnson, Jr., as follows: "It affords me pleasure to herewith enclose copy of "test" of your coal, which, if a fair sample of the run of your mine proves to be an excellent gas coal, fully equal to the best Pittsburg. I would be very glad to take in 5 or 10,000 bushels to give it a working test, and when convenient would be glad to confer with you in reference to the delivery here. It now looks as though it would answer our purpose very well if it can be delivered regularly and at short intervals."

We would call the attention of our cotemporary to the assertion of Gen. Hickenlooprr, that the Crescent coal was found "*fully equal to the best Pittsburg*," and further, that in consequence of this test the Cincinnati Gas-Light and Coke Co., not only then bought and used, in making gas, thousands of tons (*not bushels*) of this Crescent coal, but it still continues to buy and to use it, in thousands of tons, for this purpose, notwithstanding the statement of our well-informed cotemporary of Dec. 2, 1881, that "the gas companies in all the West use Pittsburg coal exclusively." Other Western gas-works are using the same coal.

The Cresent mines have this year sent to market 50,000 tons—more than one-and-one-third million bushels—of its gas coal; a number of other mines at and near Coal Valley are mining the same coal on a large scale, and all are preparing to increase their output of gas-coal to meet the demands of the gas makers—and yet, in the face of this output of millions of bushels of gas coal and its consumption in both Western and Eastern gas-works, our Pittsburg "coal and coke reporter" asserts in this very month, that "the gas companies in all the West use Pittsburg coal exclusively."—We would further call attention to the recent letter of a Western gas-engineer, Mr. McMillin, which we publish elsewhere, in which he states that in Ironton, Ohio, another Western gas company uses Great Kanawha coal, and not Pittsburg,—and gas-engineer McMillin says the former is the *better* coal for gas-making.

Resting the Western part of this case with Gen. Hickenlooper and Mr. McMillin as witnesses and the Ironton and the Cincinnati gas works as examples of "practical experience," let us state a few facts concerning the practice of Eastern gas-works, premising that if Pittsburg coal (as its "coal and coke reporter" asserted Dec. 9, 1881) "is, beyond comparison the most profitable in the manufacture of gas," then none of the gas-works that we enumerate, as using largely or exclusively other coals, are conducted on business principles.

In reply to our enquiry as to what gas-works in Virginia and East are now using Great Kanawha coals in gas making, Mr. B. S. Fitch, General Freight Agent of the Chesapeake & Ohio Railway—the road over which these coals go to Virginia and eastward—replies, under date of Nov. 30, 1881, that they

are used by the gas-works of Richmond, Petersburg, Norfolk, etc., in Virginia, and that no Pittsburg coals are used in the gas-works of this state; and, furthermore, that the Great Kanawha gas coal companies are now supplying with gas coal the following twenty-one gas-light and gas companies, some of them the largest gas makers in this country:—The Washington and the Philadelphia, the Manhattan and the Metropolitan of New York, the Peoples' of Brooklyn, the New Haven, the Newport and the Providence, the Boston, the South Boston, the Charlestown the Dorchester and the Chelsea, in Boston, the Newtown and Watertown, the Lynn, the Salem, the Waltham, the Haverhill, the Lowell and the Lawrence, in Massachusetts, and the Portland, Maine,—besides those of many other cities and towns to the eastward.—A very goodly showing of the users of coals that but eight years ago, for the first time, entered the eastern markets, and an enumeration that ought to satisfy our Pittsburg friend that some gas works in the East, by the "test of practical experience," have arrived at the conclusion that neither Pittsburg nor Liverpool coals are "indispensible for gas-manufacturing," and that Pittsburg coal is not only "equalled" and "surpassed" on the Atlantic coast by Liverpool, in the opinion of these gas-works, as proved by their acts, but is in a fair way for having to divide this field, to claim no further, with the Great Kanawha gas coals, as ones at least equally "profitable" to use, now that the Chesapeake & Ohio Railway is completed to the great Atlantic Coast harbor of Hampton Roads, where will be established, in due time, the greatest bituminous coal depot and market in America.

If necessary we could adduce further proof, to almost any extent, to show that the pretensions of our Pittsburg commentators in reference to the "indispensableness," the "exclusive use," and the surpassing "profitableness" of Pittsburg coals for gas making, have no foundation whatever in fact, even judging by their favorite method of the "demonstrations of practical tests." We have also shown that gas works, both in the West and in the East, are now using Great Kanawha coals in place of Pittsburg—for our cotemporary says they use the the latter exclusively—therefore, if we reason by our friend's methods alone, the Great Kanawha coals are better than the Pittsburg.

Iodine in West Virginia Brines.—An examination of the mother liquors of salt-brines from various salt-works of West Virginia showed Mr. A. L. Baker, of Baltimore, that not alone is iodine present, but also a considerable portion of it in a free state. The following are the results as printed in the *Chemical News*:

Salt-works.	Spec. Gravity.	Free Iodine.	Iodine in Iodides.	Total Iodines.
Snow Hill.....	1.305	4.14	....	4.14
Daniel Boone,	1.270	0.13	2.67	2.80
Newcastle,....	1.300	0.85	2.80	3.65
Hartford City,	1.285	0.87	1.82	2.69

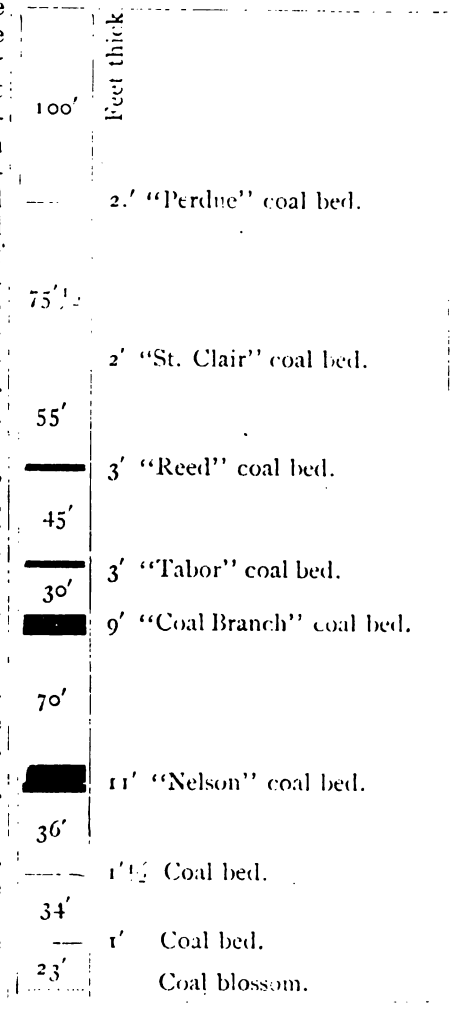
The figures given are in grains per imperial gallon.—*Eng. and Min. Journal.*

Rack-a-Rock Powder, an article made by mixing, where used, non-explosive materials, was quite successfully used, a few days since, at the Longdale limestone quarries, Alleghany county, Va. Eight drill holes, each 10 ft. deep, were charged with 50 pounds, divided among them, as we heard it, of this powder; the result of the explosion when made was the detaching and breaking up of 600 tons of limestone.

The Great Flat Top Coal-field is quite ably and quite fully treated of, for a preliminary report, by Prof. John J. Stevenson in the "Notes on the Quinnimont Coal Group in Mercer county, W. Va.," etc., which we print, in full, on pages 186-7 of this issue.

We are much obliged to Dr. Stevenson for an early copy of this report, the first one that has appeared giving publicity to any details of the characteristics of a coal field that is sure to prove, in the immediate future, not only a new source of supply for the highest grades of coals and cokes for steam, metallurgical and other purposes eastward and all along the Atlantic coast of the United States, but also an important and potential factor in the development of the iron manufacturing interests of both Virginia and West Virginia, now that the completion of the New River branch of the Norfolk & Western RR., giving this coal-field access to all the leading markets of that coast, by midsummer of 1882, is an assured fact.

We are all placed under obligations to Dr. Stevenson for his promptness and liberality in placing before the public the results of his explorations in the Virginias (as well as elsewhere) immediately after he has made them, thereby promoting the general good and stimulating further explorations by others by which any errors of observation may be corrected and additional valuable facts be brought to light, some of them in consequence of the suggestive vacancies or hints of the observations previously made.



Section of Coal Beds on Laurel Creek.
Scale 100' to 1".

To emphasize the coal-bed facts of Prof. Stevenson's paper we have converted the section he obtained on Laurel creek—at the point where the railway first reaches this coal field—into the section given as a cut, on the left, which shows only the coal beds in their relative positions and the distances between them, as they appear in the eastward escarpment of Flat-Top, from the "coal blossom" in the bed of Laurel creek, near the level of the railway, in ascending that escarpment from Laurel creek, to the northwestward, 501 feet to the crest of the "Dividing" or Tug Fork of Big Sandy Ridge, a southwestward prolongation of Great Flat-Top mountain, at the "Peeled chestnuts," the corner of Tazewell, Mercer, Wyoming and McDowell counties, the first in Va. and the others in W. Va.

This section shows that Prof. S. saw at this point of this coal field, at the date of his observations, four workable beds of "New River" (as it is now known commercially) coal, the "Reed," the "Tabor," the "Coal Branch," and the "Nelson" beds, as he designates them, aggregating 26 feet of coal, or more than twice as much, we believe, as has been found in workable beds in any section of these coals that has been opened in the New River canyon.

"The "Perdue" and the "St. Clair" beds, as Prof. S. states, were not fully opened where he saw them. It was claimed that each of these had been found 4 ft. thick; if they prove to have that thickness this section will have 6 workable beds aggregating 34 ft. of coal in this 501 ft. of section.—The "Notes" give the details about these beds and analyses of the "Coal Branch" and "Nelson" bed coals.

We are having a section of the Flat-Top coal beds fully opened on Crane creek, some 7 miles north-of-east from this Laurel creek section, where about 1,100 feet of these No. XII Coal measures are exposed; we hope to have the details of this section and a map of this Flat Top mountain—Bluestone river coal-field appear in our next number.

Great Flat-Top Coal-field Notes.

Edward T. Steele, a Philadelphia capitalist, was here a few days ago, examining into the coking processes, being chaperoned by Superintendent Wickham, of the Trotter works. Mr. Steele is the owner of forty thousand acres of coal land in Virginia, and his visit to the Connellsville region was for the purpose of studying the methods and appliances of the coke business, with a view of developing his purchase above mentioned. He is not certain that his coal will make marketable coke but is encouraged to think affirmatively. Some of our fire-brick manufacturers gave him estimates on ovens, and he will erect several to make the test.—*Keystone Courier*, Connellsville, Pa., Dec. 9, 1881.

Rogers' Va. Geological Reports.—Persons having copies of these reports for 1836, 1837, 1838, 1839 or 1840, that they will sell at a fair price, can find a purchaser by addressing Jed. Hotchkiss, Staunton, Va.

The Iron Ore tonnage of Richmond & Alleghany RR. during the fiscal year ending Sept. 30, 1881, was as follows: 7,000 tons from Ore-Siding and Price Bluff stations, ore from the "Big Hill" mines, Botetourt Co., to Williamson, to the Chesapeake & Ohio Ry., for shipment westward and to furnaces on that road; and 65 tons from Stonewall ferry, destined to Steelton, Pa.

Hereafter we are promised by General Freight Agent, B. S. Barbour—to whom we are indebted for the above information—regular monthly returns of the mineral, metal, and lumber traffic of this important Virginia railway,—one that is now running daily freight and passenger trains over the 230¼ miles of its main line from Richmond to Williamson, and the 20 of its branch from Balcony Falls to Lexington, all of it traversing territory rich in mineral resources.

Mineral and Lumber traffic of Va. Midland RR.—Mr. F. T. Hawks, General Freight Agent of the Va. Midland RR., has kindly furnished the following quantities, in tons of 2,000 pounds, of the lumber and minerals carried over that railway from Jan. 1 to Oct. 31, 1881.

	North-bound.	South-bound.	Totals.
Lumber,	21,721	9,139	30,860
Iron Ore,	15,223	8,298	23,521
Copper Ore,	30	....	30
Gold Ore,	7	....	7
Manganese	31	....	31
Barytes,	1,989	38	2,027
Totals,	39,001	17,475	56,476

Great Kanawha Gas-Coal at Ironton, Ohio, Gas-Works.

Cincinnati, Ohio, Dec. 16, 1881.

Editor of The Virginias:

Dear sir:—In reference to the gas-making qualities of the Gas Coals of the Great Kanawha, West Va., region, it affords me pleasure to say that as Superintendent of the Ironton Gas-works, I have used coals from the Kanawha valley that were superior to any that I ever used from Pittsburg or any other mines. I used the Kanawha coal for some years at the Ironton Gas Works (where I had previously used Pittsburg coal) and my successor, the present manager, continues to use coal from that locality. I am operating gas-works at two other places, and were the Gas coals of West Va. accessible, I should use them in preference to any other, even at an advanced price.

Yours truly,
E. McMillin, Gas-Engineer.

Stone Cliff Coal Mine of the Fayette Coal and Coke Co., on the Chesapeake and Ohio Railway, N. M. Jenkin Superintendent, had an output of 5,025 tons of New River or Lower Coal Mesures coals in Nov. 1881: about 2,200 tons of this were coked, making some 1,400 tons of coke, in the 60 ovens now in use at Stone-Cliff. The output of this mine was 2,500 tons in August, 2,700 in September, and 3,600 in October. All the August and September output was coked. Mr. Jenkin took the management of this mine in August.

The coal and coke from Stone-Cliff are now sold in Hamilton Columbus, Xenia, Harmer, Springfield, Dayton and Chilicothe, Ohio, and it sells coke in St. Louis. Application has been made for more than 50,000 tons of this most excellent coal for delivery during the coming year. The demand for its coke far beyond the capacity of its present oven-plant.

"What Knowledge is of most Worth."—The famous Herbert Spencer's work on Education, lately republished by the Appletons, contends that a knowledge of facts is of more value than a knowledge of words; that things are before thoughts about things, and therefore a knowledge of the realities, the laws, the facts of the world and of human life in it, is of more value than a knowledge of dead languages and the literature preserved in them; that the discipline one gets in mastering a science which may be of incalculable value if wholesome is worth more as a mental gymnastic than that which comes from useless mental exercises, as in studying ancient classics. He is a firm believer in object lessons and lays great stress on learning how to see; that living languages are better studies than dead ones; and that a knowledge that is tonic and can be used, is superior to any amount of useless intellectual lumber.—And so say we.

Gold-mining in Virginia.

The Whitehall Gold Mine.—A party of gentlemen interested in the Whitehall Gold mine arrived here Saturday and went out to the mine by private conveyance. Among them were Senator Call, of Florida, Mr. Fair, the California millionaire, and H. B. Clifford, of Arizona. They chartered a car of the narrow-gauge railroad to return in, but had to walk in from Alum Spring, as the engine of the train broke down at that place. Their comments on Virginia railroad enterprise and narrow-gauge roads in particular were both pointed and amusing. It is said this mine has yielded $1,800,000 in pure gold since its discovery, as shown by the books of the Philadelphia mint. Within a space of 3 square feet, at a depth of 28 feet, $160,000 worth of pure gold was taken out—a yield surpassing anything known in the annals of mining. Mr. Wm. A. Clear is Superintendent for the Whitehall Mining Co.

The Goodwin Mining Co., a few miles south of Whitehall, have sunk a shaft over 200 feet deep and are going to the depth of 500 feet. They have now at the depot, awaiting shipment, a large engine, and are pushing their work quietly, with a determination to succeed. Mr. Thomas J. Mc Speiden is Superintendent for this company.

The Tucker Mining Co., of Washington, D. C., Col. Geo. W. Kirk, Superintendent, are developing their property on the Trigg farm, near Brockville.

All these mines are in the Spotsylvania county portion of the Virginia gold-belt.—*Fredericksburg Star.*

It is announced that the old Whitehall gold mine in Spotsylvania county, Va., has been bought by a company, among the members of which are Senator Call, of Florida; Senator Jones, of Louisiana; Congressmen Springe and Berry, Delegate Luna, of N. Mexico, and H. B. Clifford, a mining expert of Arizona. Gold was first found there in 1806. The mine was worked by Commodore Stockton from 1848 until just before the war. It has since been owned by Gilbert R. Foy, of Pennsylvania. Nearly $2,000,000 worth of gold has been taken from the mine.—*Winchester Times.*

Population of the Virginias and of the United States.

Bulletin 271 of the 10th census presents the "final official figures of the population of the United States at the 10th-census." From that we gather the following population figures for Virginia, West Virginia and the United States in 1880.—The Indians are only those subjected to taxation.

	Virginia.	West Virginia.	United States.
Total population,	1,512,565	618,457	50,155,783
Males,	745,589	314,595	25,518,820
Females,	766,976	303,962	24,536,963
Native,	1,497,869	600,192	43,475,840
Foreign,	14,696	18,265	6,679,943
White,	880,858	592,537	43,402,970.
Colored,	631,616	25,886	5,580,793
Chinese,	6	5	105,465
Indians,	85	29	66,407

The exact population of Virginia in 1870 was 1,225,163, so it gained 287,402 between 1870 and 1880, or nearly 23½ per cent. West Virginia had 442,014 in 1870, so it gained 176,443, or just about 40 per cent. The population of the U. S. in 1870 was 38,558,371, so it gained 11,597,412, or about 30 per cent.

Ohio River Coal Trade.—From the excellent coal trade reports of the Engineering and Mining Journal—a new feature of that ably conducted journal—in its No. for Dec. 3, 1881, we gather the following: "Less than 4-million bush. of coal of the 10-million lately sent down the Ohio from Pittsburg, stopped at Cincinnati; the most of it went to Louisville and New Orleans and intermediate points, the shippers getting their own price, as the markets were all in want of a supply. The Consolidated Coal and Mining Co., reported the prices in Cincinnati per bushel, afloat, as 12cts for Youghiogheny, 11 and 12 for Kanawha and 9 for Hocking Valley; and per bushel delivered, as 17 cts for Youghiogheny, 16 and 17 for Kanawha, and 14 for Ohio River. In Louisville the wholesale price for Pittsburg coal was 12 cts per bushel, and for Kentucky 9; the retail price was 16 cts for Pittsburg and 12 for Kentucky.

The Census year Production of Iron Ore in the Virginias.

We have heretofore published the general returns of the production of iron ore in the Virginias during the Tenth Census year, but we now have Census Bulletin No. 270, dated Nov. 1, 1881, in which Prof. Raphael Pumpelly, special agent in charge of mining statistics, presents his "preliminary report on the production of iron ore in the United States during the year ending June 1, 1881," and from that we gather the following fuller information in regard to this very important mining industry in these states.

The figures refer to mining business only, and are not complicated in any way with the statistics of manufacturing iron. "The duty of filling the schedules" "was intrusted to special agents," a list of which is given,—the one "In Virginia and West Virginia, to Mr. Jed. Hotchkiss, Staunton, Va."

"This bulletin will be followed by another, giving the distribution and amounts of the various kinds of ores and their chemical analyses."

The matter from which the following facts are taken was prepared from the returns, by Mr. C. F. Johnson, Jr.

We present the figures of the tables for Virginia, for West Virginia, and for the United States.

	Va.	W. Va.	U. S.
Counties reporting, number,	9	6	135
Establishments, number,	26	8	805
Maximum yearly capacity of production; tons of iron ore,	1,404,524	140,520	13,469,917
Product of establishments in census year, tons,	169,683	60,370	7,061,829
Value of product of establishments,	$324,331	$88,595	$20,470,756
Irregular product, census year, tons,	12,643	845	909,807
Total product census-year, tons,	182,326	61,216	7,971,706
Value of total product,	439,886	101,557	$23,167,007
Value of all materials used in regular industry,	$37,783	$5,061	$2,896,011
Wages paid in establishments of regular industry,	$186 279	$63,985	$9,538,117
Men employed above ground,	555	114	16,345
Men employed below ground,	338	150	13,735
Boys under 16 employed above ground,	36	2	1,339
Boys employed below ground,	10	0	249
Total number of employes in regular establishments,	939	266	31,668
Miners, number,	412	165	17,923
Laborers, number,	438	93	12,492
Administrative force, number,	89	8	1,253
Steam-engines, number,	8	0	821
Horse-powers, total,	154	0	24,838
Value of all machinery,	$37,785	$1,500	$3,211,558
Cost of explosives used,	$13,165	$1,226	$484,432
Horses used in regular industry, number,	61	67	2,669
Mules used in regular industry, number,	97	60	1,245
Amount used as working capital,	$106,625	$10,450	$4,850,763
Value of plant,	$206,000	$16,550	$8,657,375
Value of real estate,	$1,809,125	$115,500	$48,274,149
Tons on which royalty was paid,	51,044	16,823	2,266,510
Gross amount paid as royalty in census year,	$11,333	$1,076	$981,170
Product of largest mine, tons,	28,000	29,120	280,000
Average product per mine, tons,	6,526	7,546	8,772
Average number of hands to mine,	36	33	39
Average royalty paid per ton, cts,	22.18	6.40	43.29
Average yearly income of man,	$203.36	$241.45	$308.94
Average monthly net earnings of man,	$28.89	$28.81	$33.20
Average number of tons mined per man,	1.03	1.08	0.96
Average per cent of year employed in mining,	58.66	69 84	77.55
Per cent of year not employed in mining,	41 34	29.79	22.43
Per cent of year lost in strikes,	0	0.37	0.02
Average price per ton of ore at mine,	$2.27	$1.47	$2 90
Cost of labor per ton of ore mined,	$1.10	$1.06	$1.35
Cost of material per ton of ore mined,	$0.22	$0.08	$0.41
Amount of interest, royalty and profit per ton of ore,	$0.95	$0.33	$1.14
Per cent of value of product paid for labor,	48 47	72.22	46.59
Per cent of value of product paid for material,	9.83	5 72	14.15
Per cent of value of product left for royalty, profit and interest,	41.70	22.06	39.26
Average horse power of engines to mine,	6	0	31
Per cent of miners to total force,	43.88	62.03	56.60
Per cent of laborers in total force,	46.65	34.96	39.45
Per cent of administrative force in total force,	9.48	3.01	3.95
Per cent of capital in real estate,	82.72	76.62	78.14
Per cent of capital in plant,	11.39	14.33	14.01
Per cent of capital used for working capital,	5.89	9 05	7.85
Per cent ratio of value of yearly products to total capital,	21.24	80.52	33.13
Per cent ratio of tonnage produced to maximum capacity of production,	12.08	42.96	52.45
Total product in 1880, tons,	182,326	61,216	7,871,706
Per cent of total product of U. S.	2.287	0.768	
Per cent of total value of U. S. product,	1.8980	0.4384	
Rank among iron-producing states in 1880,	8th	14th	
Rank among iron-producing states reported in 1870,	12th		

Only Ala., N. Y., Pa., and Tenn. reported iron ore mining from more counties than Va.; and only these and Ohio and Mo. reported more than W. Va,—it and N. C. and N. J. had same number of counties reporting. Of all the counties in the U. S. that reported 1-15th were from Va. and about 1-23rd from W. Va.

About 1-31th of all the iron mining establishments of the country were in Va., and about 1-101th in W. Va.

In the maximum yearly capacity for production of iron ore, only Pa., Mich., N. Y., and N. J., surpassed Va.,—those States ranking her in the order in which they are named. N. J. mines having but a little more capacity than those of Va. W. Va. ranked 11th in this particular among the 23 states reported.

In total production Va. ranked 8th, being outranked by Ala., Mich., Mo., N. J., N. Y., Ohio and Pa. W. Va. ranked 14th.—Va. produced about 1-44th of all the ore mined.

In the value of the ore produced Va. ranked 7th, Mich., Pa, N. J., N. Y., Mo. and Ohio exceeding her in this particular in the order in which they are named. In this, W. Va. ranked 15th.

In the value of all materials used in mining Va. ranked 7th and West Va. 15th, but each much below the cost in other states, showing how cheaply mining is conducted here.

In amount of wages paid Va. ranked 7th and W. Va. 13th; the former paid about 1-53rd, and the latter about 1-149th of the wages paid that year for iron mining in the United States.

Virginia employed about 1-35th of all those engaged in this business, and about 1-14th of all the administrative force, rather more than her proportion of the latter, one would think.

Norfolk & Western RR. earnings, etc.—Treasurer Wm. G. Macdowell, Dec. 10, sends us a comparison of the earnings, expenses, and net earnings of this 408-miles-long Virginia railway, from Feb. 1st to Oct. 31, in 1880 and in 1881, as follows:

	1880.	1881	Differences.
Gross earnings,	$1,516,531.85	$1,666,624.59	Increase $150,092.74 (9.9 per cent.)
Total expenses,	841,516.54	783,585.34	Decrease, 57,931.20 (6.9 per cent.)
Net earnings,	$675,015.31	$883,039.25	Increase, $208,023.94 (30.8 per cent.)
Proportion of expenses to gross earnings,	55.5 per cent	47.0 per cent.	

The large saving in expenses for the year 1881, is due to the very greatly improved condition of the roadway and equipment.

The gross earnings for November, 1880, were	$209,046.81
" " " " " 1881 (approximate) were,	216,438.54
Increase in 1881, over 1880,	$7,391.73
Percentage of increase,	3.5 per cent.

The Local Passenger rates and Local Freight rates (reduced June 1st and August 1st, 1881, respectively, in order to further the local interests of the road) being about 25 per cent lower than in November, 1880, the above increase in gross earnings is equivalent to an increase of 38 per cent in the volume of business over that of November, 1880.

Metal and Mineral Traffic of Norfolk & Western RR.

Auditor E. E. Portlock has kindly furnished THE VIRGINIAS the data, compiled from the books of the company, from which the following statements concerning the Metal and Mineral Traffic of the Norfolk and Western RR. for the month of October, have been prepared. The quantities given are in tons of 2,000 pounds.

1. THE MOVEMENT OF VA. METALS, &C.

The Pig Iron moved, was 1,166 tons; 298 to Baltimore, 159 to Philadelphia, 17 to Norfolk, 270 to Richmond, 13 to Petersburg, 25 to Lynchburg, and 12 to Southern states.

The pig iron was sent: 221 tons from Lynchburg, probably the product of the Lynchburg Iron Steel and Mining Co's furnace; 55 tons from Christiansburg; 391 from Dublin, the product of Radford furnace, we suppose; 220 tons from Max-Meadow, 247 from Crockett, and 32 from Rural Retreat stations, products of the Cripple Creek furnaces of Wythe and Smyth counties.

The Iron Ore moved was 170 tons, from Buford to Lynchburg; ore, probably, for use in the Lynchburg I. S. & M. Co. furnace.

Of Zinc Spelter 50 tons were moved from the Bertha Zinc works at Martin, 44 to New York and 3 to Richmond.

Of Pig Lead 11 tons, the product of Wythe Lead works, were sent from Max Meadow to Philadelphia.

Of Lead Shot 11 tons were sent from Max Meadow, 2 to Lynchburg and 9 to Southern states.

Of Barytes 190 tons were moved, 93 from Lynchburg, mined near there, and 97 from Marion station; destined, 11 tons to Boston, 32 to Baltimore, 113 to Philadelphia, 21 to New York, and 1 to outside lines from Petersburg.

The Lime movement was 153 tons, 5 from Petersburg, 118 from Lynchburg, 29 from Saltville and 1 from Bristol, destined, 1 to Petersburg, 96 to way stations, 20 to Richmond & Danville RR., and 36 to Lynchburg.

Of Limestone 75 tons were taken from Buford to Lynchburg, for blast-furnace flux.

Of Marble 3 tons were moved from Wytheville and 2 from Bristol,--the latter probably samples of "Tennessee" marble from the Bristol Coal & Iron Co's RR., in Scott Co., Va.

The Salt movement was 1,350 tons; 993 of Va. salt from Saltville, and 259 tons from Norfolk, 76 from Lynchburg, and 22 from Richmond & Danville RR., of imported salt. Of the Va. salt 900 tons went to Southern states; of the rest Petersburg received 100, Lynchburg 181, and way stations 169 tons.

Of Coal 1,077 tons were carried. That from Virginia was 160 tons from Christiansburg, 110 from Central, 10 from New River, 10 from Dublin, 500 from Martin, and 11 from Marion stations,—most of it semi-anthracite from the Lowest (Va.) Coal Measures, No. X. From Lynchburg 104 tons were taken, probably W. Va. coal from the C. & O. Ry. *via* R. & A. RR. From Norfolk 10 tons, from City Point 152, and from Richmond 10 tons were taken, probably Pa. anthracite. The destination of this coal was 1,181 tons to way stations and 11 to Lynchburg.

Of Slate and Stone 443 tons were carried, 256 from R. & D. RR., 177 from Lynchburg, and 10 from Saltville; destined, 25 tons to way stations, 256 to Lynchburg, and 162 to Southern states.—The notes furnished do not distinguish between slate and stone, nor do they state what stone was carried.

The aggregate movement of metals and minerals from Va., was 4,711 tons, as against 5,242 in Sept,—a loss of 531 tons, or nearly 12 per cent.

The movement of Virginia minerals and metals by this railway from Jan. to Nov., 1, 1881, has been:

Kind.	Tons.
Pig iron	12,014
Iron ore	5,784
Zinc spelter	266
Zinc ore	1,150
Barytes	3,235
Limestone	3,790
Plaster	4,027
Salt	6,251
Coal	7,162
Marble	28
Lime	693
Manganese	236
Lead ore	10
Pig lead	108
Shot and bar lead	12
Slate and stone	443
Total	45,209

Nearly all of the pig iron moved by this road is high-priced, charcoal pig, most of which is used for car-wheels.

The total movement for Sept. was 6,044 tons, so there was a loss of 507 tons.—This is doubtless in part, from the drawing of Southern metal trade to Cincinnati over the Cincinnati Southern RR., a road that is now transporting Alabama pig iron—as we recently learned from a Cincinnati metal dealer—over 400 miles for $3 per ton.

The destinations of the tons of all articles moved were as follows:

Boston	78
New York	291
Philadelphia	296
Baltimore	330
Richmond	273
Norfolk	216
Petersburg	114
Lynchburg	756
Way stations	1,473
R. & D. RR	20
Va. Mid. RR.	100
Outside from P-g	1
Southern states	1,589
Total	5,537

2. THE MOVEMENT FROM SOUTH, BEYOND VA.

The movement of metals, etc., from beyond Bristol, received from the E. Tenn., Va. & Geo. RR., was 120 tons pig iron, 43 tons zinc ore, 115 tons coal, 349 tons marble, 199 tons manganese, and 10 of ingot copper, a total of 836 tons, as against 805 in Sept.—The ingot copper was from N. C., sent to New York via Marion station.

Coal and Coke trade of Louisville, Ky.

The opening of the Elizabethtown, Lexington & Big Sandy RR., the westward extension of the Chesapeake & Ohio Ry., to travel and traffic, on the 12th of this month, gave to the Virginias all-rail connections with the entire railway system of Kentucky, and made possible certain and direct business intercourse between these states and that Virginia-descended commonwealth.

One of the first and most important of the inter-state trades that this railway communication will develop, will be that in coals from the Great Kanawha fields of West Virginia—a trade that was begun the very day the road was opened, by delivery into the heart of Blue-grass Kentucky of a train of cars laden with first class *splint coal* from the Coalburg, W. Va., mines of the Robinson Coal Co. Especially will this coal trade soon become a large one with Louisville, Kentucky's metropolis; therefore, as having a present interest, we give below the facts concerning the coal trade of that city as we find them in the First and Second Reports of its Board of Trade, those for the calendar years (as all reports ought to be) 1879 and 1880, which Mr. J. M. Wright, its Superintendent, has kindly sent us.

The price of coal in Louisville during 1880, delivered, was as follows:—

	Per bushel.		Per bushel.
Pittsburg, Pa.,	8 to 20 cents	Kentucky,	7 to 16 cents.
Pomeroy,	9 to 16 "	Cannel, W. Va,	14 to 23 "
Raymond City, W. Va.,	11 to 15 "	Anthracite	$7.50 to $9 per ton

The price of coke in Louisville during 1880, delivered, was as follows:

	Per bushel.		Per bushel.
City manufactured,	10 to 12 cents.	Connellsville	12 to 20 cents.
Gas-house,	10 to 12 "	Crushed,	11 to 13 "

Among the considerable purchasers of coal in Louisville would be the following members of its Board of Trade:—Byrne & Speed, B. Dupont, Dugan & Co., Kennedy & Blake, and Belknap & Cooper, coal-dealers; the Louisville Gas Co.; B. F. Avery & Sons, Brennan & Co., Thomas Meikle & Co., and the Faught-Deering Machine Co., makers of agricultural implements; the Ohio Falls Car Co.; the Louisville Car-Wheel & Railway Supply Co.; the Louisville Steam Forge Co., makers of car-axles; Grainger & Co., Snead & Co. Iron Works, and Fischer, Leaf & Co., founders; the Ohio Falls Iron Works; the Coleman Rolling-Mill Co., and the Birmingham Rolling-Mill Co.; the O. & M., the L. N. A. & C. R., the J. M. & I., and the L. & N. railroad companies; the Louisville & Cincinnati Mail Line steamboats; the Lithgow Manufacturing Co., stove and castings makers; and the Kentucky Wagon Manufacturing Co.

The Live Stock Traffic of the Norfolk & Western RR. during October, 1881, compiled from official sources, was 7,230 tons, of which 5,933 tons were cattle, 700 sheep, 557 hogs, and 40 mules and horses. Live stock were moved from the 20 stations of the road named below, and received from beyond Bristol, during the month, as follows :

Origin.	Cattle.	Sheep.	Hogs.	Horses & Mules.	Totals.
Petersburg,.....	10	....	....	....	10
Blacks & Whites,...	15	4	....	....	19
Lynchburg,.....	...	....	....	10	10
Forest,.....	20	....	....	....	20
Buford,.....	11	....	....	....	11
Bonsack,.....	30	....	....	....	30
Roanoke,.....	27	18	...	....	45
Salem,.....	30	....	....	....	30
Christiansburg,....	401	70	50	10	531
Central,.....	9	....	....	....	9
New River,.....	55	20	20	....	95
Dublin,.....	342	90	36	....	468
Martin,.....	90	....	....	....	90
Max Meadow,.....	630	10	....	....	640
Wytheville.....	516	45	9	....	570
Crockett,.....	94	33	....	....	127
Rural Retreat,.....	90	20	10	....	120
Marion,.....	350	20	100	....	470
Glade Spring,.....	1,372	70	30	....	1,472
Saltville,.....	137	9	....	....	146
Abingdon,.....	795	154	10	....	959
Bristol,.....	313	19	210	....	542
Total from Va.	5,337	582	475	20	6,414
" from Tenn. &c.,	596	118	82	20	816
Total movement,	5,933	700	567	40	7,230

An inspection of the above return shows that nearly all of the live stock trade of this railway is from The Valley, the Blue Ridge and Apalachia. From Midland came 29 tons, a part of which may have been from Tidewater, and from Piedmont but 30, for Buford is really in an area of The Valley, while the remaining 6,355 tons of Va. live stock came from the Blue Ridge and The Valley, and Apalachian country tributary to it. Further, it is noteworthy that the larger portion of this traffic is from Christiansburg and beyond, from the South-western Valley Plateau and the adjacent country, the high region, ranging in average altitude from 2,200 to 4,000 ft. above the sea, embracing, as a whole, the head-springs and water-sheds of the Great Kanawha and the Tennessee,—a country large in area, and as well adapted to live stock raising as any portion of America. It has a capacity for furnishing twenty or more times as much live stock freight as it now does.

The destinations and weight, in 2,000 lbs. tons, of each kind of live stock moved in Oct., 1881, were as follows :

Destination.	Cattle.	Sheep.	Hogs.	Horses & Mules.	Totals.
Norfolk.....	458	40	69	10	577
Richmond,.....	301	31	158	....	490
Petersburg,....	22	3	30	....	55
Va. Midland RR.	5,090	626	300	20	6,036
Lynchburg,....	20	....	....	....	20
Way stations,..	42	....	....	....	42
So. States,.....	....	....	....	10	10
Totals,.....	5,933	700	557	40	7,230

From the above it appears that about 5-7ths. of the movement was that of cattle delivered to the Va. Midland RR., at Lynchburg, for shipment northward.

Va. Iron Ore Items.

The Pennsylvania Steel Company has commenced mining on an extensive scale on the Hale property at Rocky Mount, Franklin County, Va.

We learn that Maj. Erasmus Taylor has entered into a contract to deliver 3,000 tons of ore a month during the next year, from the mine lately opened on his farm near Orange Courthouse. A branch of the Va. Midland RR. is to be built from Madison Run station to Maj. Taylor's mine, by the parties who have contracted for the ore, to facilitate its delivery to the furnaces in Pennsylvania. This deposit is one of the most valuable in Virginia. It has been thoroughly examined by experienced engineers and is pronounced by them practically inexhaustible.—*Fredericksburg Star.*

We learn that the Fritts iron mine, 5 miles west of this city, is developing wonderfully well. The vein has been excavated to the depth of 75 feet, and it continues to improve. In the opinion of a mining expert who has charge of the work, it will prove to be an exceedingly valuable deposit, as the ore is estimated to contain at lesat 60 per cent. of iron.

The success of this mine has stimulated owners of adjacent property to investigate the indications on their land, which are abundant in all that neighborhood, and it is quite likely that other valuable deposits will be found. This section of the county lies directly on the line of the proposed Baltimore, Western and Cincinnati Railroad.—*Winchester Times.*

Mr. Benj. Milnes, son of Hon. Wm. Milnes, of Shenandoah Iron Works, has purchased of Jackson Garrison his iron ore banks, lying near their furnace, for the sum of $6,500.—*Page News.*

"The South is experiencing an iron and coal boom. Competent judges estimate that there is at present a demand for one million tons of ore from East Tennessee, North Alabama and North Georgia. The chief cause of the great demand is the desire of the furnace companies to stock heavily with surface ore for fear that the supply will become limited, and in this event tunneled ore will have to be purchased. The price of pig will correspondingly advance on account of the increased cost of mining the latter. There is also a great demand for coal by the many industries in that section, and the mines are sorely taxed to supply it.—*Keystone Courier*, Connellsville, Pa., Dec. 16, 1881.

The Timber Traffic of Norfolk & Western RR., during October, 1881, from report kindly sent us by Auditor Portlock, was 6,477 tons of 2,000 lbs each, embracing 2,915 of lumber, 1,037 of logs, 660 of staves, and 1,865 of wood. Of this Va. furnished 2,055 tons of lumber, 892 of logs, 357 of staves, and 1,865 of wood.

The lumber from Va. came from 24 stations of the road, the quantity sent from each varying from 2 tons to 440. The largest lumber shipping stations were Windsor, 240 tons, and Disputanta, 440 tons, in Tidewater ; Church Road, 320 tons, and Pamplin, 120, in Midland ; and Marion, 194 tons, and Abingdon, 101, in The Valley.

The logs from Va., black walnut and poplar mainly, were sent from 12 stations ; of these Saltville sent 372 tons, Abingdon 161, and Bristol 117,—these three Valley stations sending 640 tons of the 892 from Va. Christiansburg sent 36 tons, Wytheville 12, Crockett 24, and Glade Spring 36. All these places are in the Great Limestone Valley, the region where the lime-loving black walnut trees grow.—The 860 tons from beyond Bristol were probably all walnut logs from the E. Tenn. extension of the Great Valley.

The staves from Va. came from 7 stations ; 39 tons from Waverly, 60 from Petersburg, 11 from R. & D. RR., 10 from Burkeville, 24 from Glade Spring, 48 from Abingdon, and 165 from Bristol.—From beyond Bristol came 303 tons.

The wood traffic, all from Va., was : 10 tons from Windsor, 446 from Disputanta, 670 from Church Road, 9 from Ford, and 43 from Buford.

The destinations and quantity of each kind of timber sent were as follows :

Destination.	Lumber.	Logs.	Staves.	Wood.	Totals.
Boston,.....	493	86	....	....	579
New York,.....	340	394	....	....	734
Baltimore,.....	101	36	....	....	137
Philadelphia.....	12	49	....	....	61
Norfolk,.....	494	....	636	10	1,140
Petersburg,.....	479	24	....	1,425	1,928
Lynchburg,.....	345	...	....	....	345
Richmond,.....	398	110	12	....	520
City Point, for outside,	30	....	....	....	30
City Point, for Old Dom. SS. Co.,.....	20	338	....	....	358
Va. Midland RR.,.....	36	....	12	....	48
Way Stations,.....	167	....	....	430	597
Tons moved in Oct.,	2,915	1,037	660	1,865	6,477
Tons moved in Sept.,	3,285	872	1,079	657	5,884
Tons moved Jan. to Nov.	27,606	12,101	5,221	9,507	54,435

The October movement was equivalent to about 3,238,500 ft., board measure, a gain of 296,500 ft. on the September movement, or one of over 10 per cent.

Notes on the Quinnimont Coal Group in Mercer Co., of W. Va., and Tazewell Co., of Va.*—By John J. Stevenson, Professor of Geology in the University of the City of New York.

Bluestone river, formed at the easterly edge of Tazewell county, Virginia, by the union of Laurel and Mud forks, flows across Mercer and Summers counties of West Virginia to New river, which it reaches at about four miles from Hinton, a station on the Chesapeake and Ohio Railway. It receives tributaries from the north, known as Little Bluestone, Mountain, Camp, Wolf, Wide-Mouth, Flippon and Simmons creeks. The first four of these rise in an elevated ridge, known as Flat-Top, which separates the waters of Bluestone from those of the Guyandot. But beyond the head of Wolf creek, the streams rise in a narrow ridge, from whose opposite sides flow those streams which form the Tug fork of Sandy river. This is a mere knife-edge, so narrow at times as barely to afford room for the country road, which follows its crest.

The surface features of the region on both sides of the Bluestone and beyond the divide westward are due wholly to erosion. The carving is stupendous. Standing on any of the high points of Flat-Top mountain and looking into Mercer county on the one pare or into McDowell and Wyoming on the other, one can comside the surface only to that of an ocean petrified at the height of a terrible storm. But this comparison fails. Narrow ridges, rising to the height of 900 to 1,400 feet, separate equally narrow valleys, in which flow rapid streams, carrying much water during a great part of the year. The slopes of these ridges are abrupt, sometimes reaching 35°, and are covered by a dense forest of white oak and poplar (tulip-tree.)

The whole region is known as "Flat-Top." All the summits between Flat-Top mountain and Peters mountain have been planed off to a rudely level surface, a condition wholly independent of the dip, which north from Bluestone varies from 7° to a mere fraction of a degree. Beautifully perfect benches were seen at from 400 to 900 feet above Bluestone river, in the ridges separating tributaries to that stream, while still higher benches were observed on Flat-Top mountain. But as no spirit-level determinations were at hand along Bluestone, no notes were taken respecting the relation of these benches.

The influence of the Abb's Valley fault, (described by Prof. J. P. Lesley, Amer. Phil. Soc., 1872,) is shown along the line of the Bluestone, for the dips are well marked, whereas as one goes northward from that stream, they become insignificant.

Along New river at Hinton, a fine-grained, grit-like sandstone occurs, which belongs to the Mountain Limestone division of the Lower Carboniferous. It forms a cliff at numerous localities on the Chesapeake and Ohio Railway both above and below Hinton, and can be traced along New river to the mouth of Bluestone, as well as up that stream to the mouth of Little Bluestone. Higher members of the group appear as one ascends the stream, and the Quinnimont coal group is reached before one comes to the junction of Laurel and Mud forks, in Tazewell county, Virginia. The top of the group is not caught within the region visited, which extends only to four miles above the mouth of Laurel creek.

A section was obtained on Laurel fork, which does not reach the bottom of the Quinnimont group, but it embraces all of the important beds of the series. It is as follows:

1.	Concealed	70′
2.	Sandstone	10′
3.	Drab shale	20′
4.	*Perdue coal bed*	2′
5.	Sandstone	20′
6.	Concealed	45′
7.	Sandstone	10′
8.	Shale	0′ 6″
9.	*St. Clair coal bed*	2′
10.	Sandstone	55′
11.	*Reed coal bed*	3′
12.	Sandstone	45′
13.	*Tabor coal bed*	3′
14.	Sandstone	30′
15.	*Coal Branch coal bed*	9′
16.	Sandstone	70′
17.	*Nelson coal bed*	11′
18.	Sandstone and Shale	36′
19.	*Coal bed*	1′ 6′
20.	Shale and Sandstone	34′
21.	*Coal bed*	1′
22.	Sandstone	23′
23.	*Coal bed*	Blossom

The section begins in McDowell county, West Virginia, on the divide separating Bluestone from Tug fork of Sandy river. It was obtained by examinations along Coal branch, Sluss' branch and Haines' Cabin branch, all entering Laurel fork, as well as upon the Tazewell and McDowell road and along Laurel fork itself. Laurel fork flows almost eastward and the head of Haines' Cabin branch is at 7 miles from the mouth of the fork. The top of the section was reached at the head of Haines' Cabin branch and of one fork of Coal branch. The highest beds are not shown, no coal blossom appears in the ploughed fields and only fragments of shale and sandstone are found in the debris covering them.

The blossom of the *Perdue Coal bed* was seen on the Tazewell and McDowell road, very near the line between these counties. It was fully exposed near the same road in making an excavation for a spring-house on the Perdue property, where it is said to be 4 feet thick, but the exposure is insignificant now. A very good exposure was found near the head of one fork of Coal branch, at a watering trough on W. L. Reed's land, where very nearly 2 feet of coal are shown. The bed is said to be 4 feet thick in an adjacent hollow, but an exposure near Mr. Reed's house indicates a thickness of not more than 15 inches. The same bed was seen near the Reed school house on another fork of Coal branch, and at Mr. J. Bailey's house at the head of Haines' Cabin branch. It is unimportant at all the exposures observed. The rocks overlying it are shown only on W. L. Reed's property. The massive sandstone, No. 5, is persistent and everywhere marks the place of the *Perdue Coal bed*. It is well shown at many places on both sides of the divide.

The interval between the *Perdue* and *St. Clair coal beds* varies from 73 to 80 feet, the former having been found on Haines' Cabin branch, and the latter on Coal branch. The exposure is not complete at any locality visited, and the character of the rocks filling the interval, No. 6, was not ascertained.

The *St. Clair Coal bed* was seen on Coal branch, Haines' Cabin branch and near the head of Sluss' branch, but no full exposure of the bed was found. It was opened at one time on the J. Bailey property near the head of Haines' Cabin branch, where it is said to have somewhat more than 4 feet of coal; but the opening is wholly filled up and only a few fragments of coal remain to show its place. Distinct blossoms were seen at many plaees near the divide, but none of them indicates a thickness of more than 18 inches. On the St. Clair property near Coal branch, the bed was fully exposed in an excavation for a spring house and the thickness is said to 2 feet. But only 19 inches were exposed at the time of examination.

The interval between the *St. Clair* and *Reed coal beds* is fairly well exposed on a stream leading from the St. Clair house to Coal branch, and contains little aside from sandstone, which varies from massive to more or less flaggy.

The *Reed Coal bed* was found only on the waters of Sluss' branch and on the Tazewell and McDowell road. Its place is concealed at all other localities examined. The first exposure is on W. L. Reed's properties on a fork of Sluss' branch, where 15 inches of coal are shown in the stream-bed, roofed by 10 inches of shale, underlying sandstone. The coal is prismatic in structure, rather soft, and contains a good deal of pyrites. An exposure on the same property, but on another fork of the stream, shows 2 feet 6 inches of coal, separated from the underlying sandstone by a few inches of clay. The blossom of the bed is shown on the Tazewell and McDowell road, which crosses it at barely a mile from the Nelson coal-pit.

No continuous exposure of the interval to the *Tabor Coal bed* was found, but the whole of it was seen. It is occupied by sandstone almost unbroken by shale. The rock is comparatively fine-grained and shows no pebbles.

The *Tabor coal bed* was seen only on Sluss' branch, its horizon being concealed at all other localities examined. The exposures on Sluss' creek are imperfect, there being no opening in the bed. It was opened at one time on Mr. Tabor's property, but the opening has fallen in and only 1 foot of coal is shown. For 6 inches on top it is hard and bony, but below that, the coal as far as seen is good. The same bed is exposed on another fork of Sluss' branch, on W. L. Reed's property, where 3 feet of good coal were seen.

The *Coal Branch Coal bed* is best shown on Coal branch at a few yards below the St. Clair crossing, but it is evidently the bed which was once opened on Elkanah Reed's property at the head of one fork of that branch; it was opened at one time in the bluff overlooking Laurel fork above Mr. Nelson's house, and its blossom is fairly shown in the Tazewell and McDowell road, at a little way from Laurel fork. Six feet of coal are exposed by a little run emptying into Coal branch near the St. Clair crossing, where 4 feet of shale separate the coal from the overlying sandstone. For 5 feet the coal is soft and clean, but below that is one foot of hard coal which seems to be quite bony. A blossom in the bank of the stream, and 15 feet above the water's edge, was stripped off and showed about 9 feet of coal, but the character and structure of the bed could not be ascertained. Samples for analysis were taken

*Read before the American Philosophical Society, Oct. 7, 1881.

from the exposure in the run, an effort being made to obtain a section of the 5 feet there shown. As analyzed by Mr. A. S. McCreath, the coal has:

Water	1.225
Volatile combustible matter	21.435
Fixed carbon	74.603
Sulphur	0.435
Ash	2.302

It is a coking coal, altogether too soft for shipping. The coke should be of exceptional purity, but the amount of volatile matter is so small as to make the strength somewhat doubtful. No full exposure of this bed was seen on Laurel creek, but at the old opening near Nelson's, on that creek, the thickness is said to be about 6 feet. The bed is nearly 90 feet above Laurel creek at the mouth of Coal branch.

The interval between the *Coal branch* and *Nelson* coal beds is occupied by a more or less flaggy sandstone which forms bold cliffs along Laurel fork and Coal branch. It was not followed above the mouth of that branch. The upper bed rests almost directly on this sandstone and only a few feet of shale separate the cliff from the lower bed.

The *Nelson Coal bed* is reached on the Tazewell and McDowell road as one approaches Laurel fork. There, at say one mile above the mouth of Laurel creek, Mr. Nelson has made an opening which has been pushed to about 25 feet. The working does not take in the whole bed, and the exposure at the mouth of the pit is such as to render measure difficult. As nearly as could be made out the structure is as follows:

1. *Coal*	5′	4″
2. Bone	0′	2″
3. *Coal*	0′	6″
4. Bone	0′	2″
5. *Coal*	2′	10″
6. Clay	0′	6″
7. *Coal*	1′	0″
	10′	6″

Nos. 6 and 7 were not seen in detail, and the thicknesses are given according to Mr. Nelson's statements, those parts of the bed having been well exposed at an opening which he had abandoned.

The total thickness of the mined portion is about 7 feet, but there would be no difficulty in taking out fully 8 feet, as only a thin slab of coal need be left to strengthen the roof. Of the part above No. 6, the whole, excepting the two layers of bone, is good, the coal being nearly equal to that of Nos. 1 and 5. The main body, No. 1 is brilliant, but shows many binders of mineral charcoal and an occasional pocket of the same material. No. 5 is not so brilliant as No. 1. The coal throughout the bed is prismatic and very soft, altogether too tender for shipping, but it cokes very readily. Ssmples from Nos. 1 and 5 were sent to Mr. A. S. McCreath for analysis. He reports the composition as follows:

Water	0.820
Volatile combustible matter	20.580
Fixed carbon	76.182
Sulphur	0.388
Ash	2.030

The only defect of the coal in No. 3, is that it contains some sulphur. This coal should yield a remarkably pure coke, though one not able to bear the burden of a high stack.

No other opening was seen along Laurel fork, but the bed can be followed without difficulty by means of the overlying sandstone down Laurel fork, and thence along Bluestone, but no estimate respecting it can be made from the imperfect exposures. An opening was worked at one time on Laurel fork above Nelson's, but it has been abandoned. There the total thickness is said to be about 11 feet. By means of the overlying sandstone, the bed was followed up the creek to the mouth of Coal branch, above which it soon goes under the stream, which in passing over it forms rapids, whereby the thickness is made to appear very great. The coal is shown for a short distance up Coal branch.

Only the blossom of *Coal bed*, No. 19, was seen. It has been ploughed up on Mr. Nelson's farm, and found to be 1 foot 6 inches thick. Its blossoms is shown in a run entering at a little way above Nelson's house. It was not seen elsewhere. No. 21 is in the spring near the house, its only exposure as far as seen. No. 23 was not observed. It is said to be present in the bed of Laurel fork at about 300 yards below Nelson's house.

The dip is nearty 2° at Nelson's pit, but soon becomes very gentle as one recedes from the influence of the Abb's Valley fault. Along Laurel fork the dip is insignificant.

On Simmons creek, Mr. George Belcher has opened a coal bed at two places. The following measurement was made on his property.

1. *St. Clair coal bed*	Blossom.
2. Sandstone	20′
3. Concealed	50′
4. Sendstone	35′
5. *Tabor coal bed*	4′

No. 1 is exposed imperfectly in the road near Mr. Belcher's house, but it has been ploughed up in an adjoining field; where its thickness is said to be somewhat more than 1 foot. The *Perdue coal bed* has been ploughed up near Mr. Belcher's barn, but its thickness was not ascertained. No exposure occurs in the interval No. 3, in which the *Reed coal bed* belongs At the upper opening in No. 5, the bed is now exposed to a thickness of 2 feet 6 inches, but it is said be 3 feet 6 inches. The coal is harder than that of any bed fully seen on Laurel fork, but it is broken by many thin partings or binders, mostly of mineral charcoal. Sulphur is present in the top 10 inches, but below that the quantity is insignificant, and the coal is an excellent fuel. The bed is 4 feet thick at the other opening, and the bottom seems not to have been reached. A large bed, probably the *Nelson*, is said to be exposed at some distance further down the creek, but it was not examined.

A section was worked out hastily on Camp creek, beginning at the crest of Flat-Top mountain. It is as follows:

1. Concealed	60′	
2. Ferruginous	0′	10″
3. Concealed	37′	
4. Yellow sandy shale	6′	
5. *Coal bed*	Blossom.	
6. Clay	1′	
7. Yellow sandy shale	31′	
8. *Perdue coal bed*	1′	6″
9. Clay and variegated shale	15′	
10. Sandstone	30′	
11. Concealed	65′	
12. *St. Clair coal bed*, seen	1′	6″
13. Sandstone	90′	
14. Shale with *Tabor coal bed*	1′	
15. Sandstone or sandy shale	20′	
16. Concealed, said to contain a *coal bed*	30′	
17. Sandstone and some shale	40′	
18. *Nelson coal bed*, seen	3′	
19. Concealed	10′	
20. Sandstone	25′	
21. Shale and shaly sandstone	30′	
22. Carbonaceous shale	0′	3″
23. Shale	16′	
24. *Coal bed*	Blossom.	
25. Imperfect exposure	55′	
26. Sandstone	30′	
27. Shales and sandstones imperfectly exposed	100′	
28. Sandstone	50′	
29. Sandstones and shales	400′	

Ending where the trail leading to Wolf creek crosses Camp creek, at a mile and a half above its mouth. This gives nearly 600 feet of coal-bearing strata on Camp creek, the rocks below No. 26 being regarded as belonging to the Lower Carboniferous. No calculation for the dip was made and a closer examination would doubtless lead to a moderate change in the thickness of several of the intervals.

The only coal beds which have been opened are Nos. 8, 12 and 18, but none of these was in shape for measurement at the time of examination. No. 12 is exposed in the bed of the run, and its thickness is said to be nearly 3 feet. The coal is clean, free from pyrites and slates, is soft and should yield a good coke. No. 18 was mined for local use at the junctioa of the forks of Camp creek. Its thickness is said to be 4 feet 2 inches. The coal is soft, clean and admirably fitted for blacksmiths' use. No. 24 was once exposed near the creek at half a mile below Reed's mill. The thickness is said to be 3 feet.

The following section of the Lower Carboniferous rocks was obtained in passing from Little Bluestone to Mountain creek:

1. Conglomerate	20′
2. Imperfectly exposed	110′
3. Yellow shaly sandstone	45′
4. Concealed	25′
5. Gray to yellow shaly sandstone	80′
6. Imperfectly exposed	85′
7. Conglomerate	10′
8. Concealed	225′
9. Limestone	3′
10. Imperfectly exposed	370′
	973′

Exposures of dark red shales occur frequently in the intervals 2, 6 and 10, and No. 10 is made up almost wholly of such shales. This section brings one to the sandstone which forms the river bluffs in the vicinity of Hinton.

Lumber and Lumbering on Chesapeake & Ohio R'y.

Few persons know of the vast timber resources of the greatly varied belt of country that is traversed by the Chesapeake & Ohio Railway in the five hundred miles of steel-tracked highway that its trains now traverse across the Virginias from Newport-News on the great Atlantic harbor of Hampton Roads to the mouth of the Chaterawha (Big Sandy) in the Ohio, and perhaps fewer know the present development of the lumbering business along this line;—to increase that knowledge we propose to present, in a series of articles, some facts concerning these timber resources and the use now made of them, beginning at the Big Sandy, the border river of West Virginia and Kentucky.

The Chaterawha river of the Indian,—the Big Sandy of the Englishman—with an air-line length of about 100 miles drains nearly 5,000 square miles of Kentucky, West Virginia, and Virginia, all of Coal-measures territory, nearly all of it still covered by noble forests. The outlet for this region is at Catlettsburg, Ky., a thriving town on the Ohio, at the mouth of the Chaterawha and on the line of the C. & O. R'y., 430 miles from Richmond. Many million feet of lumber, in logs, are now annually floated down this river and out into the Ohio for the mills below along that river.—The railway now has none of this lumber trade.

At Huntingtou, on the Ohio, 10 miles eastward from the Big Sandy, is the permanent steam saw mill of H. L. Foote, having a capacity for sawing 20,000 ft. of lumber, board-measure, daily. It has connected with it lath, stave, floor-matching, and broom-handle mills. It draws its supply of logs from Guyandot river that enters the Ohio a short distance above Huntington.—This mill has a most excellent customer near at hand in the very extensive car-building shops of the Ensign Manufacturing Co., which just now is now filling an order for 300 freight cars for the C. & O. Ry.

Guyandot river rises on the borders of Virginia, in Tazewell county and flows northwest, through 100 miles of air-line, draining over 1,500 square miles of nobly timbered country, into the Ohio at Guyandot station, 3 miles east of Huntington. —During the present year more than 40,000,000 ft., b.m., half of it oak and the other half poplar, walnut, pine, etc., have been floated down this river in logs; fully 30,000,000 ft. of this went to Cincinnati and other mills on the Ohio.

Ona station, Cabell county, W. Va., 14 miles east from Huntington, near Mud river a Guyandot tributary from the east that drains some 200 square miles of well-timbered country, shipped some 406 car-loads of lumber during this year,—93 eastward and 255 westward. Near it are four portable steam saw-mills, viz:

1. D. B. Morrison's, B. S. McComas, Superintendent, 2½ miles from Ona, having a capacity for sawing 10,000 ft. daily. It has a planer attached. During the present year, this mill shipped 1,500,000 feet, half of it oak and half of it pine and poplar. It furnished the C. & O. 40 car-loads, sent 15 to Baltimore, and the rest of its product West by C. & O.

2. N. Newman's portable steam saw-mill, located 3½ miles from station, daily capacity 6,000 ft.; sawed 400,000 ft., half pine and half oak, this year; most of which was sent West by rail.

3. James A. Watterson's portable steam saw-mill, located 2½ ms. from station, daily capacity 5,000 ft.; sawed 400,000 ft. this year, ¼ of it pine, ¼ tulip-poplar, and ½ oak; sold 15 per cent of product to C. & O., remainder sent West by rail.—In 1882 expects to saw 100,000 ft. a month.

4. J. B. Shoemaker's portable steam saw mill, 3½ ms. from station, on Merrit run of Mud river; daily capacity 5,000 ft.; may increase its product in 1882.

Milton station, Cabell county, W. Va., near Mud river, 18 miles from Huntington, shipped during this year some 239 car-loads of staves, 75 of lumber, and 20 of logs; 334 car-loads in all. At and near this station are these mills:

1. James Lyons & Co's stave mill, at the station, James A. Lyons, General Manager, Ludwig Schimiet, Timber Agent. During the rise late in this month this company ran down to its boom in Mud river 1,400,000 staves, of which those for barrels will be shipped West and those for pipes East, both by rail.

2. G. B. Martin has a portable steam saw mill, just completed, daily capacity 10,000 ft., at Kilgore's switch 1½ ms. east from Milton; will ship 5 car loads this month.

3. Price & Woodruff have a portable steam saw mill at Mud River bridge, 2 ms. west from Milton; daily capacity 7,000 ft. Saw pine, oak and tulip poplar, all for Ensign Car. Mf'g. Co., Huntington.

4. J. A. Johnson of Milton, now has 400 black walnut, tulip-poplar and oak logs in Mud river which he will at once saw and ship.

Hurricane station, Putnam county, W. Va., 25 miles east from Huntington, shipped 197 car loads of staves, logs, lumber, bark, and heading in 1881, mostly eastward. Near it are these mills:

1. Shore & Thompson's 2 portable steam saw mills, on Charles creek of Mud river, 2 ms. from Lyons' switch, which is 2 ms. west from Hurricane. Capacity each 5,000 ft. a day. Run for James Lyons & Co.

2. H J. Benedict's portable steam saw mill, 6 ms. south from station; daily capacity 5,000 ft.; began to saw last Aug. Have sold 300,000 ft. to be shipped to Huntington, to G. A. Rhodes, Agent for J. F. Ellis.

Coal river is crossed by the C. & O. at St. Albans, where that river flows into the Great Kanawha, 39 miles east from Huntington and a few miles above where the C. & O. reaches the Great Kanawha. Coal river has an air-line, N. W.-S. E., length of about 75 miles and drains some 1,100 square miles of country abounding in what one may properly call magnificent timber. During 1881 more than 13,000,000 ft. of lumber in logs have been floated down this river into the Great Kanawha and on down the Ohio to mills on that river. It is estimated that 40,000,000 ft. more are now cut and on the banks of this river ready to be rafted westward.

St. Albans station, Kanawha county, W. Va., 39 ms. west from Huntington, at the mouth of Coal river, shipped during 1881 over 266 car-loads; of which 223 were lumber, 28 staves, and 15 logs, mostly black walnut, nearly all to James River wharves, Richmond, Va., for shipment thence by water. The mills that ship from St. Albans are:

1. C. P. Huntington's permanent steam saw-mill at St. Albans—the largest and best appointed mill on the C. & O.—leased by George Moore, lumber dealer, of 9th Ave., 14th and 15th Sts., New York., J. C. Allen, Superintendent. Daily capacity 30,000 ft.; sawed 3,000,000 ft. in 1881, three-fourths of it tulip-poplar (for which Coal river is celebrated), and the rest black walnut and white oak. Its logs all come from the Coal river country. During the year 1881 it sawed 128,000 ft. of black walnut for Mahley & Russell, of Indiana, (which, of course, was sold as "Indiana" walnut), and 14,000 ft. of black walnut and 22,000 ft. of tulip-poplar for the C. & O. Ry.

2. Mohler & Son have just put up a portable steam saw-mill at Peytona, 35 miles up Coal river from St. Albans, and will have another ready in February next. They now have 1,500,000 ft. in logs in the boom at their mill. They expect to saw 3,000,000 ft. in 1882, all of which will go to English & Holt, of New Haven, Conn., via C. & O. to James River wharves and thence by sailing vessels. The lumber will be dried before shipping and then sent out at three different times during the year at the rate of 5 car loads a day. English & Holt have contracted for all the merchantable lumber Mohler & Son can furnish.

It appears, then, that in the 39 miles of the C. & O. from its western end in W. Va.: (1) There are now 12 saw-mills in operation having a capacity for producing about 120,000 ft. of lumber daily, or about 36,000,000 ft. a year. (2) That the C. & O. took to market during 1881 from this section over 1,100 car-loads of lumber, or near 7,000,000 ft., counting 7,000 ft. b.m. per car when loaded with poplar, black walnut or pine, and about 5,000 ft. b. m. when loaded with white oak, averaging about 6,000 ft. b. m. for all kinds of lumber. (3) That over 100,000,000 ft. of lumber went to market from this region, from the river basins of the Chaterawha, the Guyandot, and the Coal rivers, during 1881, (allowing that as much went out from the Chaterawha as from the Guyandot. (4) That from present indications, over 200,000,000 ft. will go out from this region during 1882.

The immense Movements in Coal and Iron about the Mouth of the Great Kanawha.—Says the Wheeling *Register's* Point Pleasant correspondent: "Gath" never uttered truer words than when he said last week that "about the mouth of the Great Kanawha are now maturing the grandest movements in coal and iron the country has ever seen." Here the new railroads in progress from the Atlantic, via the Elk and Kanawha rivers, debouch into the Ohio valley. Here the hematite, magnetite and specular ores of Virginia, the coke of New river, and the splint, gas and cannel coals of Kanawha, must come for distribution. Here the material for iron making—cheap fuel and generous ores—the material out of which the secrets of civilization, the problems of conquest, the mysteries of empire are evolved, must be dispatched, not alone to the furnaces and forges of your own and adjacent cities, but to remoter manufacturing centres in the West and Northwest, and down the Ohio valley. It is here that the railroad connection will be formed by which the people of the upper Ohio and beyond will be brought into close relations with old Virginia and the new South. Three-fifths of the products manufactured west of the Alleganhies and seeking Southern markets tend to this great national deposit of commercial exchange.—Here the great railroad enterprise of this section of the state, the Atlantic and North-Western, has located its immense bridge over the Ohio. Across it will come the Ohio Central, the Hocking Valley, the Delphos and Toledo, the Cincinnati and Ohio, as well as the traffic of more distant Western systems, all seeking to make here, by way of the Atlantic and North-Western, connections with the Richmond and Allegheny, helping to realize the dreams of the old projectors of the James River and Kanawha canal, who, when they marked out the pathway of commerce from East to West by way of the James and Kanawha, had little thought that the traffic upon which their vision rested would be carried by a great railroad on the tow-path of the canal, rather than by barges on the bosom of its waters.

The Crescent W. Va. Coal Mines.—We visited the Crescent mines this week, and lay before our readers an account of them. Captain W. R. Johnson, the proprietor, being absent, we were referred to Mr. Bartlam, the Superintendent, who very kindly gave us the desired information. The Crescent vein is the same as the Coal Valley seam, and from its thickness is supposed to be the basin of this great gas coal bed on which several parties are operating, on both sides of the mountain. The Crescent mines are located in the outskirts of Coal Valley, and the seam varies from 5 feet 6 inches to 6 feet 7 inches, with a 16 inch parting of fine splint coal, one foot from the top. It finds ready sale both East and West as a gas and fuel coal. It has been in operation nearly 5 years, and the main entry is 2,105 feet into the mountain, with a breast of about 700 feet. West Crescent mine is connected with this by rooms, although the "tipples" are 900 feet apart. The capacity or output for both entries, working 130 men, is 350 tons per day. Captain Johnson is now working 65 men and turning out 175 tons at the upper tipple only.

Captain Johnson is now in Cincinnati in the interest of his works, and his shipments West are very large. The completion of the extension of the C. & O. Ry. opens up a much larger trade and a demand for our coal through Kentucky.—*Coal Valley* (W. Va.) *Courier*, Dec. 17, 1881.

The Tariff Question.—The tariff question is destined to give the Democratic party a great deal of trouble in the future, if it is not most dexterously managed. There is a growing sentiment in favor of the protection of home industries, and with the spread and growth of manufactures in the South, the opinions of our people are bound to change. "Protection" views have grown to such an extent even in the West that such distinguished men as Gov. Hendricks and ex-Senator Vorhees have "gone back on" free trade.

The great hope of Virginia for the future is in manufactures, and there will not be established in the State any large manufacturing establishment, especially in iron, that will not be the centre of "protection" influences, and those influences will be felt more and more, every year, as manufactures increase.—*Fincastle* (Va.) *Herald*, Dec. 8, 1881.

Coal Trade of Cincinnati in 1880-81.

The courtesy of Col. Sidney D. Maxwell, Superintendent of the Cincinnati Chamber of Commerce, has put us in possession of the advance sheets of the report of that body on the Coal Trade of Cincinnati during the fiscal year ending August 30, 1881.—From that report we gather the following items that have a special value for our West Virginia coal miners, particularly those in the Great Kanawha fields.

The coal trade of the year was one satisfactory to dealers, although its volume was not equal to that of the preceding year, in consequence of the condition of the Ohio and its coal-furnishing tributaries during much of this fiscal year, frozen during the winter and low during the summer. Most of the supplies from the Pittsburg region came down late in Dec., in March and April, and in June, after which the river continued very low, and the year ended with no supply of coal on hand. From this the report draws the conclusion that it is futile for Cincinnati to depend on rail facilities for a coal supply, for these reasons: With the river in good condition, rail transportation is greatly at a disadvantage in rates, and with the temporary nature of suspended navigation, it is at a disadvantage in facilities, especially when the roads are abundantly taxed with other business, so that, in almost any possible event, the hope of our industries, with their extraordinary requirements, as far as fuel is concerned, rests on the river. This has been sufficienily demonstrated, and furnishes an appeal, of which none can be stronger, for the improvement of the Ohio and its tributaries to the utmost. Every dollar expended to this end, is in the direction of the toiling artisans and laborers of the Ohio Valley. The two movable dams which have been completed in the Kanawha river, and the two to be finished in the approaching year, give promise of material assistance to the great fuel interests. It is believed by those competent to judge, that, with these improvements completed in the past year, at least three or four millions of bushels would have been added to our supplies."

The facilities for handling coal from the river were greatly increased by the opening of five large new and improved elevators during the year.

The average quotations for 1879-80 and 1880-81 for the different coals, delivered, in cents per bushel, were as follows:

	1880-81.	1879-80.
Pittsburg,	15.00	13 22
Ashland,	13.18	11 07
Ohio River,	12 36	10 44
Hocking Valley,	13.55	12.70
Raymond City,	13.97	11.97
Muskingum Valley,	13.55	11.93
Campbell's Creek,	14.87	12.55
Cannel,	22.88	19.89

This shows that the Great Kanawha coal averaged, for 1880-81, but 0.13 of a cent less than Pittsburg, as against a difference of 0 67 of a cent in 1879-80,—a gain in position of over 400 per cent, one showing that the Pittsburg claim of "ever and always one cent a bushel" more for its coal than for that of the Kanawha, must be changed for the year 1880-81 to one of a little more than one-seventh of one cent,—A change THE VIRGINIAS predicted in commenting on the coal trade of Cincinnati last year. The price of anthracite, delivered, per ton, was $6.68 in 1879-80, and $8.03 in 1880-81.

Prosperity of Virginia.—"If any one thinks Virginia a poor-house let him go to Low Moor, in Alleghany county, Cripple Creek valley, in Wythe, Stapleton, in Amherst, and remember what he saw there in the days when we boasted of our wealth.

Virginia is richer today than she was before the war, if capacity to pay taxes is the test. Nearly every former slave pays more taxes than his master paid for him, and the minerals and railroads of the state give an increase to the taxable real estate greater than was lost. We believe the agricultural production is larger and know that in manufactures we are greatly ahead of 1860.—Lynchburg, Va., *Advance*.

The *Volatile Matter* in Pittsburg coals ranges from 29.662 to 37.980, in Kanawha proper from 21.38 to 46.50, and in the New River from 17.57 to 34.43.—We remark concerning this element that, except for gas-making, it detracts from the value of a coal for nearly all purposes, and especially for coke-making, when it contains more than about 25 per cent of volatile matter.

The Lower Silurian Brown Hematite Beds of Southwest Virginia.* —By Benjamin S. Lyman, of Philadelphia, Penn.

In the south-eastern part of Smyth county, in Southwestern Virginia, within half a dozen miles south and east of the town of Marion, between that town and Iron mountain, are thirty or more iron ore banks and natural exposures of Lower Silurian Brown Hematite, such as are found in such numbers along the great Valley of Virginia and its continuation north-east to Canada and south-west to Alabama. A rough topographical survey of a part of this iron district near Marion, shows, by means of two or three parallel sections from north-west to south-east across the general strike, that the rocks form two important saddles with a basin between, and that the ore exposures occur at corresponding distances on the opposite sides of the northern saddle and of the basin, as if they were the outcroppings of four beds of ore regularly bedded with the other rocks; and at three or four of the ore banks the solid beds are to be seen. At the other exposures the ore has the same appearance as at almost all such exposures throughout the Valley; namely, it is in solid lumps of irregular shape and of every weight up to three hundred tons or more, scattered irregularly through brown, gravelly loam. The brown hematite is sometimes very pure, but often contains rounded or angular grains of pebble or white quartz, and sometimes is merely a cement that binds together angular pieces of light brown sandstone. All these beds seem to lie within the Virginia and Pennsylvania Geological formation, No. 1., wholly below the Calciferous sand rock of No. 11.

These brown hematite exposures of Smyth county resemble very closely in every respect a great number of similar ones of Lower Silurian age, from New Brunswick to Alabama, that are described either originally or at second hand in "Lesley's Iron Manufacturer's Guide." Among these are a dozen or more that show the ore to be unmistakably in regular beds conformable to the other rocks. A few of the deposits seem (like Mr. David Graham's iron ore in Wythe county, Va.) to come from the weathering of the upper part of a fissure of iron pyrites.—The rest are more or less irregular deposits of loose lumps of ore of various size and shape, scattered through brown loam, sometimes with white clay or sand, and the lumps are commonly less mixed with these other materials at a depth from the surface of the ground. There seems, indeed, to be nothing in these deposits to remove the impression made by the correspondence in position, by the solid bedding occasionally visible and by the other characteristics of the Smyth county exposures, that the iron ore was deposited in regular beds of greater or less extent and thickness at the same time as the other rocks, and that they have been broken into fragments at their outcrops, and that these fragments of hard and heavy ore have accumulated in quantities of various extent according to the lay of the ground, mixed with the loam that comes from the more thorough comminution or decomposition of the other softer rocks and of a portion of the ore itself. The lumps of ore are sometimes stalactitic in form and sometimes are hollow geodes, and these forms may have existed in the original beds, or they may perhaps have originated later in some cases.—These deposits or loose lumps of brown hematite in loam seem, then, to be similar to accumulations of outcrop blocks of any bed of rock, such as sandstone, for example, or to the black dirt of a coal outcrop, except that the effect of the hardness and heaviness of the ore must be regarded. They are like the alluvial deposits of gold and tin ore, except that the lumps of iron ore are larger, owing to their coming from thick, solid beds, and they are lighter. As the lumps of ore in such deposits have been accumulating ever since the denudation of the rocks began, there might easily be found among the ore or near it, not merely the more or less decomposed outcrop rubbish of neighboring rock beds, but now and then comparatively recent vegetable deposits like the Brandon and Mont Alto Lignites. At two or three points in Virginia and Pennsylvania, lumps of carbonate of iron have been found mixed with this brown hematite, and this would go to show that the ore was originally deposited as a carbonate like coal measure beds of carbonate of iron, and has since been changed into brown hematite either in the solid bed or in the lumps scattered through the loam, a change that happens so often with the coal measure carbonates. The greater age of the Lower Silurian ores would not probably make the change more complete in their case, for they seem to have been thickly covered up until after the Carboniferous epoch; but the position of the lumps of ore in loose loam would be especially favorable to the change.

This view of the origin of the deposits of loose lumps of brown hematite in loam may be of great practical importance, since it would help to show by the dip of the rocks and the lay of the ground something of the probable size of such a deposit and in which direction a solid bed of ore might be looked for. The solid bed of ore may, however, be much less regular in thickness than the beds of iron ore of later age, and very likely resemble the early beds of magnetic iron ore.

The supposition some have entertained that these lumps of ore are derived from the percolation through the loam of water charged with iron dissolved out of rocks that contained iron in the form of iron pyrites or otherwise, and that the lumps are therefore concretionary in origin, and the result of a segregation so thorough, that it sometimes leaves white clay or sand in contact with the ore, has more than one difficulty. The lumps are commonly not of the shape of concretions, for these must be more or less rounded or nodular, as they are formed about centres, and they could never be irregularly angular. The coal measure nodules of iron ore are placed also with a certain regularity in the slates where they occur, and not a trace of any such regularity is found in the Lower Silurian lump deposits. It seems hard, too, to conceive of so complete a segregation as would be necessary, in loose, gravelly loam; and it would be more natural to expect that iron-bearing waters, in soaking through such loam, would form an iron ore comparatively homogeneous, but mixed throughout with the impurities of the loam. It would seem, rather, as if the effect of the percolation of the water in these deposits had been commonly to give a ferruginous covering and character (taken from the ore) to the materials of the loam when they came from rocks that did not have that character.

The strength of the argument furnished by these Smyth county ores depends in a measure upon the accuracy of the survey; but although this was rough, the limits of error in each cross section are so small compared with the distances apart of the different beds that, in a similar case, the identity of coal beds exposed on opposite sides of a saddle or basin would be quite undoubted, and the uniformity in these distances over a space of several miles is even surprising. The correspondence of the beds in the different cross sections is, however, somewhat less certain in some parts. On one section the outcrops of the four beds are exposed on each side of the northern saddle, and probably the three upper ones are exposed on the north side of the southern saddle; then on a section about two miles to the east, the three lower beds seem to be exposed on the north side of the southern saddle; and on a section two miles and a half still further east, the upper and lower beds seem to be exposed, also on the north side of the southern saddle. A little allowance must be made in two or three of these places for the slipping of the ore lumps down hill from the real outcrop of the solid ore bed. The exposures marked in these sections are almost all very near to the section lines, so that there can be no appreciable error from any possible slight mistake in the direction of the strike, in projecting the exposures upon the sections; and, with occasional small allowances for slipping of the ore lumps down hill, all the other exposures observed correspond well with the theoretical outcrops of the four beds.

*From Proceedings of Amer. Association for the Advancement of Science, Burlington Meeting, 1867, pages 114-117,—under the title of "The Lower Silurian Brown Hematite Beds of America."—The distinguished author of this paper has kindly furnished us a copy of it for publication. We have changed its title somewhat, to localize its important statements.—EDITOR.

Weight of Connellsville Coke.—Mr. J. E. Bird, manager of the Big Etna furnace, Ironton, Ohio, informs us that he has found, as the result of weighing it very often, that the Pittsburg or Connellsville coke weighs, with great uniformity, 41.5 pounds to the bushel.—Coke is generally rated at 40 lbs per bushel; this added weight must be from added water in consequence of exposure to the incidents of river transportation and the rains accompanying a rise.

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